THE Journal

OF THE AMERICAN DENTAL ASSOCIATION

SEPTEMBER

1955

CONTENTS

Caries symposium: introduction....269
Effect of sugars on resistance to caries—Sognnaes....270
Effect of sugars on the oral flora—Williams....278
Oral biochemistry of sugars—Volker....285
Sugar content of foodstuffs and caries—Bibby....293
Self-curing resins for repairing dentures—Stanford....307
Refrigeration anesthesia in cavity preparation—Eustice....316
Endodontics in complete mouth reconstruction—Seltzer....320
Grand Rapids' decade of progress in fluoridation—Parran....332
Tolerance to antibiotics by oral lactobacilli—Dreizen....338
Cases and comments....344
Reports of councils and bureaus....346
Editorials....349
News of dentistry....357
The reader comments....380a
Book reviews....380d
Current literature....381
Deaths....385
Directory....387
Announcements....389

NINETY-SIXTH ANNUAL SESSION

VOLUME 51

NUMBER 3

SAN FRANCISCO • OCT. 17-20

Ritter Equipment Gives You More...

INSTRU-MATIC UNIT
AND
CENTURY MOTOR CHAIR

operating ease

a touch of the switch and instruments float quietly from concealed to operating position. Century Chair's automatically compensating backrest allows easier positioning of your patient.

efficiency

exclusive Ritter automatic water supply fills cup, shuts off—refills after patient use. A touch of your toe brings the Century Chair to the exact height you want.

flexibility

new low position of chair ideal for work on lower jaw, particularly extractions. New, powerful engine, built into Instru-Matic unit, assures wider range of speeds, use of modern high-speed techniques.

prestige

patients need no special eye to recognize the modern appearance and beauty of your equipment, secure in the knowledge that the equipment fully complements your skills.

patient comfort

patient time in the Ritter Century Chair will be more relaxed and comfortable . . . thanks to contour molded foam rubber cushions, "lounge chair" armrests, and the new, universal foot platform.

See your Ritter dealer now, or write the Ritter Company, Inc., 109 Ritter Park, Rochester 5, New York.

Ritter Company Inc.

The Journal of the American Dental Association is published monthly by the American Dental Association at 222 E. Superior St., Chicago 11, Ill. Printed in U.S.A. Second class mail privileges authorized at Chicago, Ill. Subscription $7.00 a year in U.S.A.; $8.00 foreign. Issue of September, 1955, Vol. 51, No. 3. Copyright 1955 by the American Dental Association.

FIRMILAY

REG. U.S. PAT. OFF.

Perfect for Acrylic Veneer Crown Castings!

A Jelenko Precision Casting Gold, ideal for reproducing the fine margins and details of veneer crown castings.

Strength and Hardness amply adequate to stand up under incisal or occlusal loads and abrasion.

Certified to meet A.D.A. Specification No. 5 for TYPE C—HARD Golds.

GOLD COLOR

per dwt. — $2.75

Use "FIRMILAY" also for All Crown and Inlay Abutments, Easily Burnished in Quenched Condition.

Recommended for Short-Span Stationary Bridges when Heat Hardened.

Cast by THERMOTROL

J. F. Jelenko & Co., Inc.

DENTAL GOLDS—SPECIALTIES—PRECISION CASTING EQUIPMENT

136 West 52nd Street • New York 19, U. S. A.

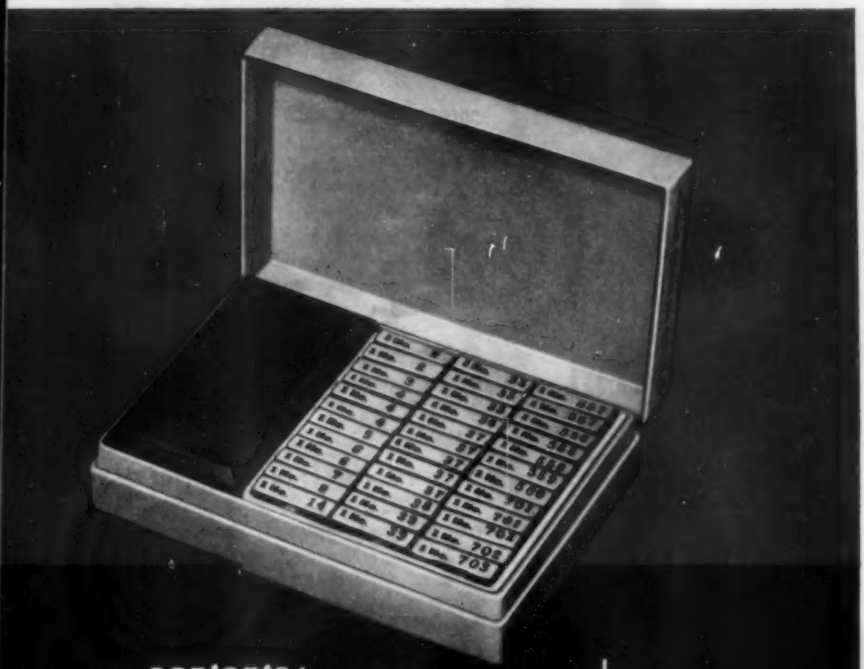
Fissure: Nos. 59, 557, 558, 559, 560, 701, 702, 703

S. S. White Carbide Bur heads are made of tungsten carbide specifically selected for efficiency in cutting tooth structure. Shanks and necks are chrome-plated. For speed in cutting all burs have six blades, except numbers 6 and 8 which have eight blades. Fissure bur blades are helically cut for increased cutting speed and less vibration. Inverted Cone bur blades are slightly rounded at the corners for extra strength.

you can save $10 with

ASSORTMENT 36A

including black plastic block



contents:

11 Round Burs
1 Wheel Bur
12 Inverted Cone Burs
12 Fissure Burs

36

VALUE $57.60
SAVING $10.00

PRICE
$47.60

Plastic block purchased individually Price 50c

THE S. S. WHITE DENTAL MFG. CO.

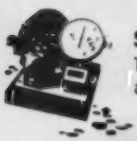
Philadelphia 5, Pa.

7 Reasons why YOU will like TICONIUM

LOW-HEAT — A low-melting alloy electrically cast into a relatively cool mold produces fine-grains in the structure of the final casting.

TICONIUM CASES FIT — Plaster-bound investment, hydrocolloid impression material and a rigidly controlled technique produce fine-grain, accurate cases.

SOLDERABILITY — Work is handled easier; cases can be re-finished better; warpage of original casting is minimized.



STRONGER CLASPS — Ticonium clasps have better adjustment and longer life.

BETTER PHYSICAL PROPERTIES — Tests prove the greater resiliency of fine-grain, low-heat Ticonium.

ELECTRIC MELTING — Ticonium is melted uniformly. The human element is minimized by use of an electric casting machine.

PRESCRIBED FOR SURGERY — Ticonium #25 has been tested and used successfully in surgery for many years.

TICONIUM
413 No. Pearl St., Albany 1, N. Y.

TICONIUM CASES FIT !

increase your income...

by offering your patients a dental payment plan!

RESERVE PLAN PUTS DENTAL CARE WITHIN REACH OF EVERYONE!

When a patient says, "I can't afford it," tell him about the Reserve Plan for budget dentistry. Through Reserve Plan's convenient payments, patients discover they can easily afford complete dental care . . . without undue hardship on them and with less bothersome bookkeeping worries for you.

Reserve Plan is helping dentists in 41 states and Puerto Rico to build bigger, more secure practices. To find out more about this practical way to increase your income, fill out and mail coupon today.

Reserve Plan Inc
TRADE MARK

922 Walnut Street Kansas City 6, Missouri

RESERVE PLAN, INC.
Suite 1020, 922 Walnut Street, Kansas City 6, Missouri

Please send me, without obligation, information on your plan for buying monthly payment notes given for dental care.

Name _____

Address _____

City _____ State _____

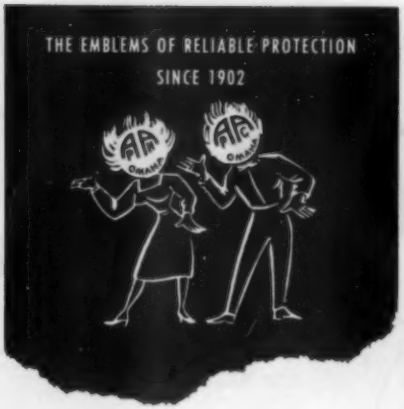
OVER A HALF CENTURY OF SERVICE

55th Anniversary Year

CRESCENT DENTAL MFG. CO.

1839 South Pulaski Road, Chicago 23, Illinois

—and hundreds of other quality products
for dentists and laboratories



We cordially invite your inquiry for application for membership which affords protection against loss of income from accident and sickness (accidental death, too) as well as benefits for hospital expenses for you and all your eligible dependents.

all premiums come from → PHYSICIANS SURGEONS DENTISTS ← all benefits paid to

PHYSICIANS CASUALTY AND HEALTH ASSOCIATIONS
Omaha 2, Nebraska
$4,500,000 ASSETS
$22,500,000 PAID FOR BENEFITS

for caries-active patients

recommend non-cariogenic

Amurol®

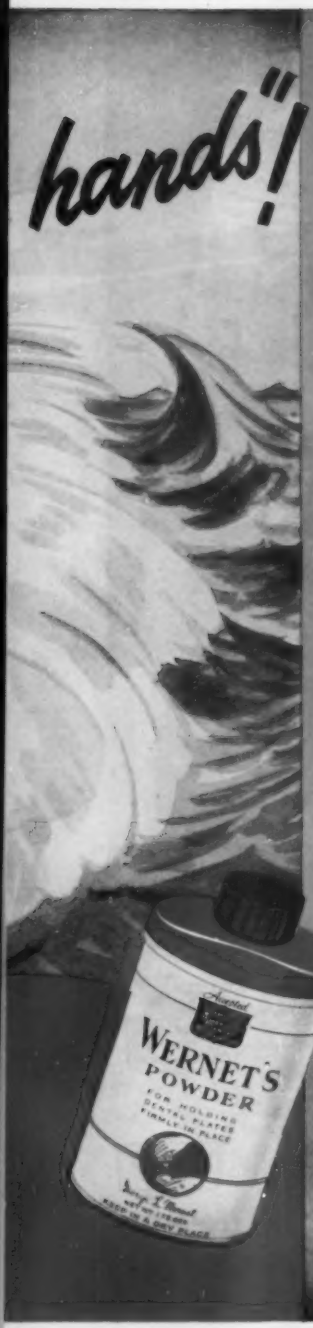
Sugarless Mints

REFRESHING MINT FLAVOR!
Deliciously sweet, but free from sugar. Available through drug, department and health food stores.

Samples and literature on request. Please give druggist's name and address.

AMUROL PRODUCTS COMPANY
116 S. Michigan Ave., Chicago 3, Ill.

"Look ma---
no
He may be in over his depth at any moment, unless he holds that grabrail securely. New denture wearers, too, often feel on the verge of precipitation into embarrassing situations, unless they have extra help during the difficult period of adaptation.
Wernet's Powder can provide an extra measure of reassurance, to help make the course of adjustment smooth and successful. Not only does it improve retention and stability of the denture under awkward manipulation, but it provides a soft, resilient cushion to reduce initial discomforts, and encourage patience and perseverance.
Particularly in the presence of anatomical handicap or psychological hazard, dentists find Wernet's Powder invaluable in helping the patient to gain full proficiency with fewer difficulties.
WERNET DENTAL MFG. CO., INC., JERSEY CITY 2, N. J.
Wernet's Powder
Speeds the Mastery of the Denture



WERNET DENTAL LORE

SEPTEMBER 1955

In the belief that certain metallic substances possessed occult therapeutic properties, ancient Chinese practitioners as far back as 2700 B.C. often treated toothache or pain in the gums by inserting metal needles near the affected part, and then (after removing the needles) by burning a piece of vegetable wool at the sight of the puncture to "draw out the humours" that had provoked the pain. The needle technique (known as "acupuncture") found an exponent even as late as 200 years ago, when a Connecticut practitioner Elisha Perkins (Yale Class of 1727) claimed to cure many disorders of the mouth and body through its use, finding a ready sale for his needles at five guineas a pair.

• • •

Because Antonie van Leeuwenhoek, the inventor of the microscope, had not attended a university, his observations on the structure of dentine (published in 1678) were ignored — not only by his learned contemporaries, but also by succeeding generations of scientists. It was not until 1833 that his findings were accidentally discovered by the anatomist Anders Retzius, and were confirmed by him. All for the want of a sheepskin!

• • •

The chief deterrent to the adoption of antiseptic methods by the dental profession in the 1850's and 1860's was the desire to keep the patient in a pleasant frame of mind. The dental operating room was as ornate, cozy and receptive to dust as the patient's living room, with both the dental chair and the instrument table covered with plush. The dentist himself would hide his forceps in his coat pocket until the actual moment of operation. Modern methods of antisepsis were not completely accepted until the end of the century.

• • •

The ancient Hindus of India provided themselves with flashing smiles by affixing jewels set in gold to their canines or incisors. Nowadays, India is still making its contribution to the flashing smile (modern version) of many Americans by their exports of gum karaya, the basic ingredient of Wernet's Powder.

FREE PROFESSIONAL SAMPLES

Dept. 15-J

WERNET DENTAL MFG. CO., INC., Jersey City 2, N. J.

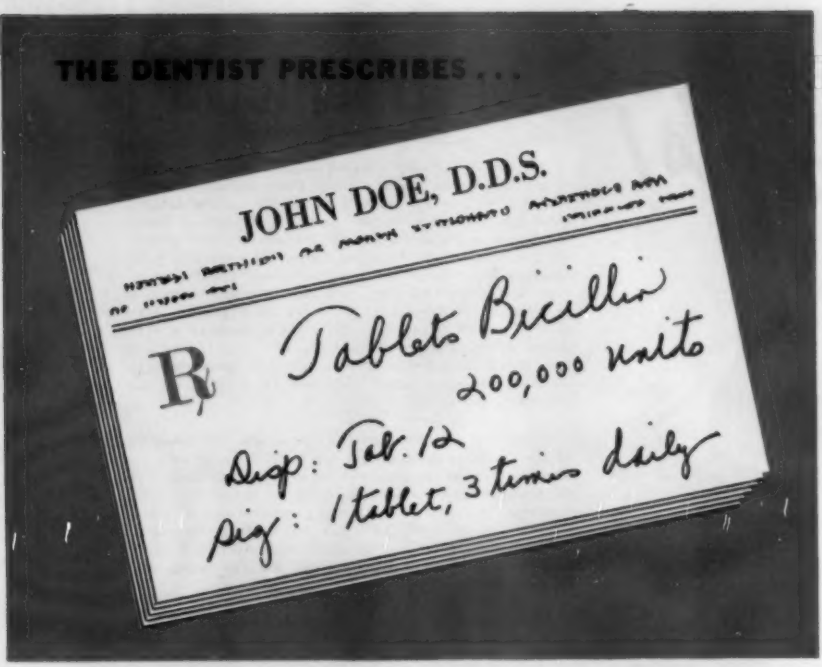
Please send me professional samples of Wernet's Powder.

Dr. _____

PLEASE PRINT

Address _____

City _____ Zone ____ State _____



He prescribes Oral BICILLIN because: "Oral administration of 200,000 to 300,000 units of benzathine penicillin G [BICILLIN] every 6 to 8 hours will produce adequate blood levels for the treatment of most penicillin-sensitive infections. . . ."[1] In both prophylaxis and adjunctive treatment, Oral BICILLIN offers prolonged antibacterial blood levels, resistance to gastric destruction, maximal safety, convenient dosage regimen.

1. Council on Dental Therapeutics: J.A.D.A. 49:715 (Dec.) 1954

PRESCRIPTION PADS ON REQUEST

Accepted COUNCIL on DENTAL THERAPEUTICS AMERICAN DENTAL ASSOCIATION

Supplied: Tablets, 200,000 units, vials of 36; 100,000 units, bottles of 100. Oral Suspension, 300,000 units per 5-cc. teaspoonful, bottles of 2 fl. oz.; 150,000 units per 5-cc. teaspoonful, bottles of 2 fl. oz.

TABLETS SUSPENSION

Oral BICILLIN®

Benzathine Penicillin G (Dibenzylethylenediamine Dipenicillin G)

Wyeth® Philadelphia 2, Pa.

Penicillin with a Surety Factor

THE RULE OF 3

for good resin restorations

CAULK CAVITY PRIMER

to make the cavity chemically receptive

Conditions dentine and enamel for more intimate contact with resin. Increases efficiency of mechanical lock. Reduces incidence of percolation.

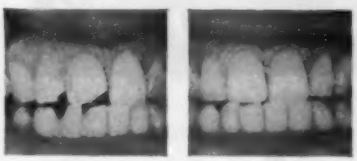
BRUSH-ON TECHNIC

for tightest possible adaptation

By flowing liquid against powder and tooth surfaces in successive layers, you have the virtual equivalant of no shrinkage!

COLORFAST KADON

for permanent esthetic effect



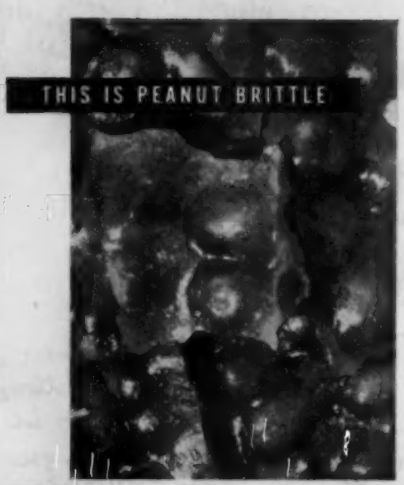
Before After

Even under intense exposure to ultraviolet rays (per standard ASTM test) no color change is detectable by the unaided eye.

P.S. For posterior fillings of lifelike appearance, use BYCOR where indicated. This resin-like silica composition is easy and speedy in manipulation. Provides tight adaptation, quick setting, prompt finishing.

FOR MODERN MATERIALS CALL ON

CAULK Milford, Delaware

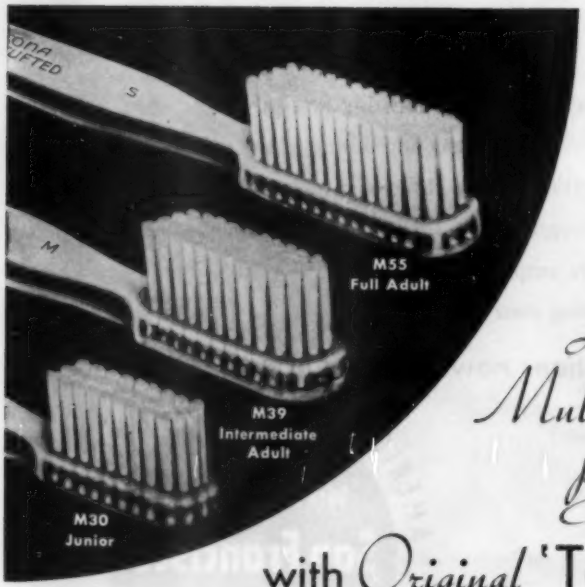


Q. what do they have in common?

A. **THEY'RE BOTH BRITTLE-HARD!**

In the case of the impression, this means a more accurate registration of detail. Yet, even though TRU-RIDGE sets brittle-hard, it flows easily . . . is never sluggish. It's an all-purpose material adaptable to any technique. Try it. You'll like it. Thousands of dentists do. At all good dental dealers.

MIZZY, INC., Clifton Forge, Va.
N.Y. Office — 175 Fifth Ave.
Better Materials for Better Dentistry

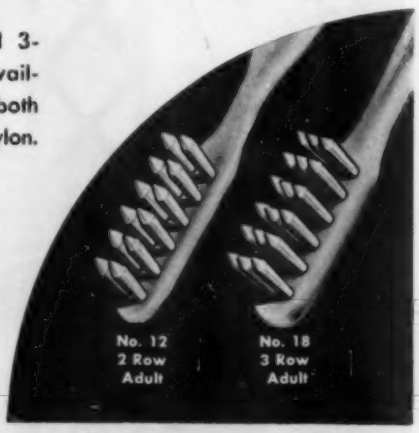


Lactona Multi-Tufted Brushes with *Original* 'Tooth-Tip'

Lactona Multi-Tufted Brushes in three brush designs, and with a choice of Medium or Soft TYNEX (nylon) textures.

A Lactona Multi-Tufted brush is carefully designed; every edge and surface of the handle is carefully rounded; there are no blunt corners, no excess width to interfere with its effective use.

Lactona 2-row, twelve-knot, and 3-row, eighteen-knot brushes are available in a full range of textures, both Genuine Natural Bristle and Nylon.



For a complete brush schedule showing special professional prices on all styles and textures, please write to:

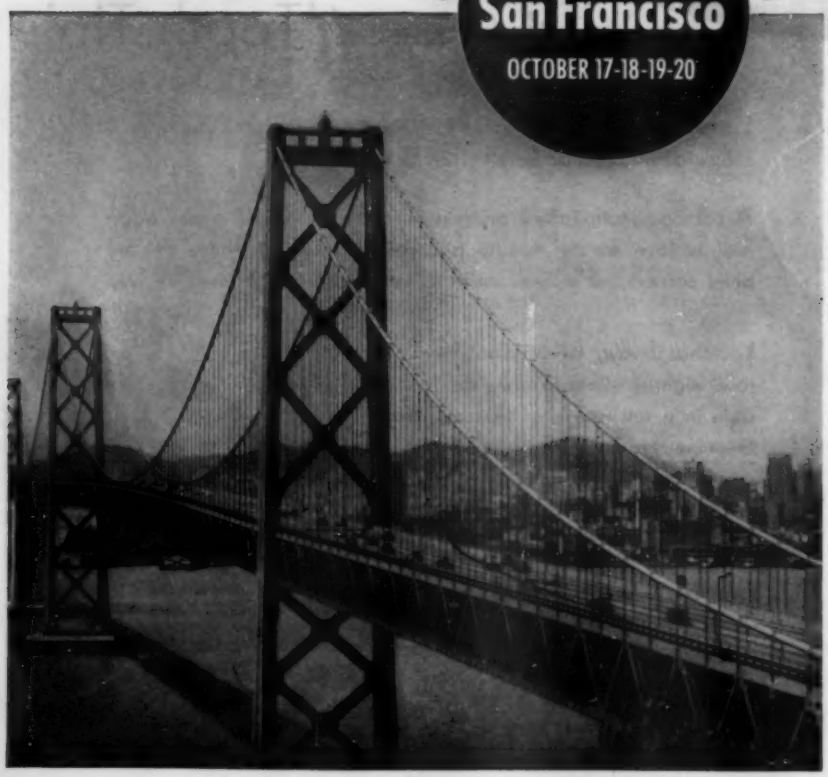
LACTONA INCORPORATED
Saint Paul, Minnesota

An outstanding scientific meeting awaits you
in the setting of one of the world's
most fascinating cities. You will never forget
nor regret a trip to this west coast metropolis.
There are ample accommodations for all
. . . so bring your whole family.

Make reservations now!

(Use the official application form in your A.D.A. Journal)

AMERICAN DENTAL ASSOCIATION
96th Annual Session
San Francisco
OCTOBER 17-18-19-20



A New Book...

every dentist will want!

a service to the profession

Doctor:

Now you can get the complete story of PBP dental management in this new book just published by Professional Budget Plan. It's a guide to sound business management in the dental practice and describes the ethical procedures used by PBP in bringing good management and good living to thousands of dentists.

You will want this new book because it is complete — it is authoritative — it is a *sensible* solution to the business problems of dentistry. Send for your copy today— there is no obligation whatsoever.

Visit the PBP Exhibit — Booth 211 — at the 96th Annual Session of the A.D.A. Oct. 17-20 — San Francisco

For your free copy, fill out this coupon and mail it today!

PBP — A NATIONAL ORGANIZATION — MADISON, WISCONSIN ®

PROFESSIONAL BUDGET PLAN
Madison, Wisconsin

PROFESSIONAL BUDGET PLAN A-95
303 East Wilson Street, Madison 3, Wisconsin

Dr.....

Street Address.....

City.....Zone.....State.....

amalgam squeeze cloths
tough and strong—excellent for expressing mercury from amalgam filling material
sanitary headrest covers
disposable and moisture-resistant—fresh, easily-attached cover for each patient guards headrest from oily stains
nufold dental napkins
soft and absorbent—ideal for massaging gums or wiping instruments—valuable wherever a high-grade, sterile gauze is indicated
DENTAL DIVISION

SEPTEMBER 1955 THE Journal VOLUME 51 • NUMBER 3

OF THE AMERICAN DENTAL ASSOCIATION

Effects of sugars and other carbohydrates on the teeth: symposium

The following papers, which comprised a symposium entitled "Effects of Sugars and Other Carbohydrates on the Teeth," were presented at the ninety-fifth annual session of the American Dental Association held in Miami, Fla., last fall. They are timely, informative, and some are provocative. They mark another milepost in the study of the etiology of dental caries and point the way to further study of the complexities inherent in the relationship of carbohydrates and man's most prevalent disease.

Each of the four authors acknowledges a relation between carbohydrates and the incidence of dental caries. They recognize, however, and so state, that many honest and sincere dental authorities have made and continue to make many loose statements in their zeal to reduce the incidence of the disease—statements that sometimes outstrip sound scientific data.

Destruction of tooth structure by cariogenic action is not a simple phenomenon, and the dangers of oversimplification are stressed by all panel members. The complexity of the phenomenon is the keynote that rings through their presentations. Bibby's emphasis on the "form, composition or manner in which sugar is used," the analysis of the oral flora by Williams, the contribution of heredity and environmental growth factors in the preeruption and posteruption maturation of the teeth pointed out by Sognnaes, and the need for sound investigation voiced by Volker are but a few of the high lights of this symposium which raise it above the level of the commonplace.

Effect of ingested sugars and other carbohydrates on the resistance of teeth to caries

Reidar F. Sognnaes, D.M.D., Ph.D., Boston

Crossroads where newly gathered information appears to complicate rather than simplify the problem invariably are reached in the pursuit of investigative work. Recent advances in caries research have led scientists to that stage. The solution to the caries problem is hardly around the corner. New avenues of approach, however, have been opened. Empiricism has given way to controlled experiments that have resolved much controversy, which always prospers on inadequate information. As a result of this progress, there has emerged a less conflicting concept of the caries problem, although a more complex one than formerly held.

DEFINITION OF THE PROBLEM

It has been demonstrated that caries production in laboratory animals is determined by five major influences. The evidence for this was reviewed in a recent symposium on advances in experimental caries research which was presented at the annual meeting of the American Association for the Advancement of Science.[1] The review was documented by reports of carefully controlled experiments, in which the several factors have been studied singly, other factors being equal. The major influences are as follows, in chronological order from the period of conception to function:

1. Genetic history.
2. Developmental-nutritional background.
3. Salivary-dental interrelationship.
4. Oral microorganisms.
5. Oral food debris.

These factors and many others undoubtedly coexist and determine to various degrees the eventual caries experience in every human being. Heterozygous as man normally is, some of these factors are beyond control. Few if any can be studied singly in any conceivable human group without due regard to incidental but nevertheless important overlapping variables.

In this report it is necessary to recognize that a limited phase of the problem is being dealt with. It is important, furthermore, to be precise in the definition of terms if there is to be agreement in the interpretation of results.

At first glance, the developmental period of the tooth and the environmental period may appear clearly separated by the period of tooth eruption when the

Presented as part of a panel discussion "Effects of sugars and other carbohydrates on the teeth" before the Sections on Research, Pedodontics and Public Health Dentistry, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

Harvard School of Dental Medicine.

1. Sognnaes, R. F., editor. Advances in experimental caries research. Washington, D.C., American Association for the Advancement of Science, 1955.

seemingly fully developed crowns of the teeth emerge into the mouth. There may be, however, a significant overlapping of these two periods which would suggest that the resistance of the teeth to caries may be modified not only during the primary development of the teeth but also after the teeth erupt.

Little or no direct evidence is available to permit a positive answer to the question whether excessive use of sugar and other refined carbohydrates during the period of tooth development affects the subsequent susceptibility to dental caries. Indirectly the answer may be sought by re-examining the validity of theories which have failed to take into account the nutritional background during the period of tooth development. Furthermore, because the consumption of sugar and other refined carbohydrates is part of the total caloric intake, the indirect effect on the intake of other nutrients, which are more directly concerned with tooth development, must be considered.

In the discussion of these points, information from three areas of research will be included: (1) clinical caries research in human populations; (2) experimental caries research in laboratory animals and (3) fundamental observations on the structure, chemistry and behavior of the tissues involved in caries.

CLINICAL OBSERVATIONS IN MAN

Since the formulation of the chemical-parasitic theory by W. D. Miller, the profession has been acutely aware of the potential dental damage resulting from the excessive consumption of sugar and other refined carbohydrates. Several clinical tests[2-4] have been interpreted as being in full accord with this theory. Yet the evidence has neither been sufficiently specific nor completely conclusive for the following reasons. In these studies a great variety of sweetened products such as sweetened canned fruits, jam, marmalade, chewing gum, sweets, pastry, candy, sweetened beverages, chocolate and so forth were withdrawn simultaneously from the diet. Consequently, it is not possible from these observations to refer to any one specific form of refined or sweetened products as being more harmful than others. No proof of damage could be leveled against any one, and, in practice, it has proved unrealistic to hope for elimination of all refined carbohydrates from modern life. Moreover, these studies were carried out in children whose dentition was partly in the developmental stage. It could not be established with certainty, therefore, whether the observed reduction in caries rate was due entirely to factors operating externally to the teeth, within the environment of the mouth, or in part due to changes in the quality of the teeth themselves, changes which took place during the period of calcification, maturation and eruption.

Under these circumstances, it is not surprising that other caries investigations in institutionalized children have been interpreted differently from those mentioned previously. For example, in the studies by Boyd[5] and others in this country and by Mellanby[6] in England, dietary changes in regard to carbohydrates were thought to result in an improved quality of the teeth. Neither school of thought can be accepted at the exclusion of the other. Both developmental and environmental factors may well have played a

2. Bunting, R. W. Bacteriological, chemical and nutritional studies of dental caries by the Michigan research group. J. D. Res. 14:97 April 1934.

3. Jay, P. Role of sugar in the etiology of dental caries. J.A.D.A. 27:393 March 1940.

4. Becks, Hermann. Carbohydrate restriction in the prevention of dental caries using the L.e. count as one index. J. California D.A. 26:53 May-June (Supplement) 1950.

5. Boyd, J. D. Long term studies of dental caries progression among teenaged inmates of custodial institution. J. California D.A. 26:30 May-June (Supplement) 1950.

6. Mellanby, May. Diet and the teeth: an experimental study. Part I: Dental structure in dogs; Medical Research Council, special report series no. 140, 1929. Part II: A. Diet and dental disease. B. Diet and dental structure in mammals other than dogs. Medical Research Council, special report series no. 153, 1930. London, His Majesty's Stationery Office.

part in the outcome of the clinical trials.

Another kind of clinical observation, subject to similarly opposing interpretations, appeared in the literature following the two world wars. In several European countries, a noticeable reduction in the incidence of dental caries was observed in connection with wartime conditions. The majority of observers have interpreted this reduction in caries rate as another indication that the reduction in the use of refined carbohydrates and sweets had caused a favorable change in the oral environment and hence had decreased the external injury to the teeth. But again, other investigators, notably Mellanby and Mellanby,[7] have suggested that in addition to the reduction in refined carbohydrates, the food consumed during the war showed an improvement in the calcifying property which became reflected in the structure of the newly developed teeth. A comparison of such data from various war-torn countries appears to reveal a certain time lag between the reduction in refined carbohydrates and the reduction in the incidence of caries.[8] This time lag may be interpreted as suggesting a developmental influence in addition to the change in the oral environment of the functioning teeth.

A more recent report[9] has suggested that the improvement in the teeth during World War II may be explained in part by dietary changes which began prior to the war and benefited the developing teeth which came into function during the war. In this study, particular significance was attributed to the calcifying property of the prewar diet (vitamin D). It was suggested that a reduction in the incidence of rickets and a reduction in the incidence of caries were concomitant.

These conflicting interpretations of the wartime caries reduction again indicate that the observed changes in caries prevalence have not been satisfactorily explained on the basis of contemporary changes in the intake of refined carbohydrates on the one hand and in the oral environment on the other.

One extensive practical application of current knowledge about nutrition and teeth was undertaken by Toverud.[10] In a community health center, nutritional advice was given to young mothers over a period of years from their pregnancy through the infancy and childhood of their children. The conclusion was reached that the greatest caries reduction resulted in children who had benefited from this change in dietary habits from the early period of tooth development. Admittedly the purpose was not merely to study the effect of eliminating sugar, but to substitute protective foods for the sugar.

In order to obtain more precise information on the effect of sugar on caries in man, it is necessary to design studies in which certain factors are studied singly, other factors being equal. One recent study has attempted to do that.[11] This study was carried out at an institution for mentally deficient young adults in Sweden. The purpose was to study the specific effect on the teeth of sugar in various forms. Thus, instead of eliminating a number of sweetened products at the same time, an attempt was made to study the relative effect of sugar when given in great quantities but in different physical forms. It was found that it makes a very great difference whether sugar is given in a form or by a procedure whereby it is retained in the mouth for long periods of time. When

7. Mellanby, M., and Mellanby, H. Reduction in dental caries in 5-year-old London school-children (1929-1947). Brit. M. J. 2:409 Aug. 28, 1948.

8. Sognnaes, R. F. Analysis of wartime reduction of dental caries in European children with special regard to children in Norway. Am. J. Dis. Child. 75:792 June 1948.

9. Kantorowicz, A. Karies und Kriegsernährung. Deutsche Zahnärtzl. Ztschr. 8:suppl., 41 June 1953.

10. Toverud, K. Utheim. Beretning om de første 6 ers arbeid ved Oslo kommunes helsestasjon for mor og barn paa Sagene (1939-1944). Oslo, Fabritius and Sönner, 1945.

11. Gustafsson, Bengt E. Tandkaries och kolhydrater; Vipeholms-undersökningarna, 1947-1951. Lund, Berlingska Boktryckeriet, 1953.

great quantities of sugar were given in the form of caramels or toffees, especially between meals, a very great increase in caries resulted over a period of several years; when given in the form of highly sugared flour products (sweetened bread) at meals only, a moderate caries increase occurred; when given in liquid form and at meals only, no caries increase above the control was found in the course of several years. In other words, it is not possible to generalize completely about the effect of sugar on the teeth.

This study does not give direct evidence as to what extent the developing teeth may be influenced by a diet when a large proportion is in the form of highly sweetened products, because most of the persons were of an age when all or most of the teeth were fully developed, calcified and in function. Detailed examination of the tabulated material in the original report, however, reveals one significant observation which is pertinent. There were certain persons who remained caries-free throughout the years of study, no matter in what quantity and form sugar was given. This observation suggests that under certain circumstances, the quality of the teeth themselves, which in this instance were developed prior to the experimental period, was such that they resisted the caries attack, no matter how drastically the oral environment was changed by the introduction of tremendous quantities of sugar, even though sugar was given in a physical form which would tend to cling to the teeth and be retained in the mouth for long periods. Although this observation was secondary to the main purpose of the experiment, it is mentioned here as an interesting preamble to similar observations in experimental animals.

OBSERVATIONS IN EXPERIMENTAL ANIMALS

The value of experimental caries observations in laboratory animals lies in the greater possibilities of controlling many of the variables previously referred to, both with regard to the exact composition of the diet and the precise period of tooth development.

Arbitrarily, three stages in the developmental period can be distinguished, all of which should be considered in this connection: namely, the primary formation and calcification of the teeth; the secondary maturation, immediately prior to and after the time when the tooth emerges into the mouth and finally, the least understood period, after the teeth have reached functional occlusion.

In several recent studies, in which inbred strains of rats have been employed, it has been observed that the diet fed to these animals during the early period of tooth development and calcification, significantly affected the susceptibility of the teeth to caries. For this purpose, the animals had been maintained on a purified diet which was complete in all nutritional essentials and which contained for its carbohydrate fraction a high percentage of sugar. Thus a relatively comparable oral environment in all animals under study was attained. In spite of this comparable situation existing after tooth eruption, a considerable difference in caries susceptibility could be observed by changing the diet fed to the animals before tooth eruption. For example, in rats and hamsters raised on a stock diet composed of untreated food products, the teeth of the offspring appeared to be much more resistant to caries than those of the animals fed the purified diet from prenatal life on.[12-15]

On the basis of such observations, it

12. Sognnaes, R. F. Possible role of food purification in the etiology of dental caries. Science 106:447 Nov. 7, 1947.

13. Sognnaes, R. F. Caries-conducive effect of a purified diet when fed to rodents during tooth development. J.A.D.A. 37:676 Dec. 1948.

14. Sognnaes, R. F. Experimental rat caries: production of rat caries in the presence of all known nutritional essentials and in the absence of coarse food particles and impact mastication. J. Nutrition 36:1 July 1948.

was proposed that the stock diet contain, in addition to currently recognized nutrients, certain elements which might have a special bearing on the production of caries-resistant teeth. A long term study recently has been completed.[16] In this study a salt mixture from the stock diet was added to the purified diet used during the period of tooth development. This inorganic ash contained, in addition to adequate amounts of required minerals, various amounts of trace elements. Teeth developed and calcified under this regimen proved to be significantly more resistant to decay when exposed to the same posteruptive diet previously used. Conversely, a high caries susceptibility was observed in teeth which developed during subsistence on the purified diet, which contained 67 per cent sugar as the carbohydrate fraction, but otherwise was complete in all known nutritional essentials. With regard to this developmental effect, there is no evidence that sugar *per se* in the purified diet brought about the greater susceptibility to decay. The degree of purification of the diet is believed more important than the type of carbohydrate.[12, 15] It can only be concluded that an indirect nutritional effect may occur when highly refined and sweetened products occupy a large portion of the caloric intake so that certain trace factors occurring in natural foods are being replaced. It has recently been shown that this trace element effect on caries is not limited to fluorides but may involve one or more of a dozen trace minerals as well as certain organic constituents of the diet.[16, 17]

In a study on hamsters conducted by Mitchell and Shafer,[18] the caries-producing diets were composed of less purified materials than the one used in the study made by Sognnaes.[13-14] Although the results of the two experiments were not exactly alike, the same general trend toward a higher caries susceptibility in the offspring of those females which were transferred to the caries-producing ration early in pregnancy was observed in both studies.

Observations which suggest a similar developmental influence in rhesus monkeys have been made.[19] Teeth which developed in the laboratory while the monkeys were being fed the purified diet have had a relatively high caries susceptibility. Conversely, the teeth which were formed while the monkeys were in their natural habitat in India have not decayed even though the monkeys have been fed a purified ration with a sucrose content of 73 per cent for six years postdevelopmentally.

It has been recognized for some time that the availability of phosphorus varies in different types of cereals. Sobel and Hanok[20] observed the effect of various dietary calcium and phosphorus ratios in rodents during the period of tooth development. They found that the calcium-phosphorus ratio of the diet altered not only the calcium-phosphorus ratio of the blood but also the ratios of minerals deposited in the developing teeth and bones. It is noteworthy that these changes were obtained at a calcium and phosphorus balance insufficient to produce a fully rachitic process. It was found that a low dietary calcium-phosphorus ratio resulted in a markedly decreased carbonate-phosphate ratio in the mineralized tissues.

15. Sognnaes, R. F. Is susceptibility to dental caries influenced by factors operating during the period of tooth development? J. California D.A. 26:37 May-June (Supplement) 1950.

16. Sognnaes, R. F., and Shaw, J. H. Experimental rat caries. IV. Effect of a natural salt mixture on the caries-conduciveness of an otherwise purified diet. J. Nutrition 53:195 June 1954.

17. Shaw, J. H., and Sognnaes, R. F. Experimental rat caries. V. Effect of fluorine on the caries-conduciveness of a purified ration. J. Nutrition 53:207 June 1954.

18. Mitchell, D. F., and Shafer, W. G. Effects of caries-producing diets initiated at various stages of pre- and postnatal development of the hamster. J. D. Res. 28:424 Aug. 1949.

19. Shaw, J. H., and Sognnaes, R. F. Developmental factors in experimental animal caries. In Advances in experimental caries research, R. F. Sognnaes, editor. Washington, D. C., American Association for the Advancement of Science, 1955, p. 82.

20. Sobel, A. E., and Hanok, A. Calcification of teeth. I. Composition in relation to blood and diet. J. Biol. Chem. 176:1103 Dec. 1948.

This observation led to speculation as to the caries susceptibility of teeth of varying composition, because hydroxyapatite with a high carbonate content has a higher acid solubility than hydroxyapatite which has a low carbonate content. Sobel, Hanok and Shaw[21] later showed that cotton rats whose diet and teeth had a high carbonate-phosphate ratio had a much higher incidence of carious lesions than cotton rats whose teeth had a low carbonate-phosphate ratio. These definite chemical differences and definite differences in caries susceptibility existed even though the teeth of the two groups of cotton rats were indistinguishable histologically.

Another possible indication of differences in caries susceptibility which depend on the source of carbohydrate has been described by Nizel and Harris.[22] They observed a high caries incidence in hamsters fed a diet composed of corn grown in New England and whole milk powder prepared from milk produced in New England. Littermates fed corn and whole milk powder produced in Texas had a significantly lower dental caries incidence. Definite changes in the incidence of caries on a postdevelopmental nutritional basis were reported. McClure and Folk[23] at the National Institutes of Health similarly suggested a posteruptive nutritional or dietary effect on caries. The carbohydrate, fat and protein percentages were identical in the diets of the experimental rats, but heat treatment of the diet caused a much higher incidence of dental caries. The results do not appear adequately explained on the basis of a direct effect of these diets on the oral environment of the teeth. Instead their results suggest that the fully formed teeth may be capable of metabolic changes.

Whatever the mechanism by which excessive consumption of sweets and other refined carbohydrates affect the teeth, there is no reason to suggest that this mechanism is identical prior to, during and after eruption of the teeth. With regard to the fully formed functioning teeth, it would appear that the effect is to a large extent a direct external one, acting primarily as a substrate for the microorganism within the environment of the mouth. Prior to tooth eruption, on the other hand, it would appear that the effect is an indirect one, a replacement effect as suggested previously. As the teeth pierce the gum and emerge into the mouth, a third intermediary mechanism may be active. This mechanism is as yet poorly defined, but it appears to be related to the caries resistance of the teeth themselves rather than to the direct injury of the oral microorganisms, their substrate or their products.

Hodge,[24] Braunschneider and coworkers,[25] and Shaw[26] observed a decrease in caries susceptibility with advancing age of the teeth in experimental rodents. This observation suggests that the caries susceptibility may be reduced appreciably even though the same oral environment is imposed, provided the teeth can be protected from the caries-conducive agents during the early period after tooth eruption.

Similar observations have been made in rats and hamsters fed a finely powdered purified diet containing 67 per cent sucrose.[13,14] In these studies it was suggested that the beginning of tooth eruption shortly after birth was one of the critical periods in determining the future caries susceptibility of these rodents. Likewise, it was shown by

21. Sobel, A. E.; Hanok, A., and Shaw, J. H. Composition of bones and teeth. Relation to caries susceptibility. Abstracts of 124th meeting of the American Chemical Society, no. 173, Sept. 1953, p. 72C.

22. Nizel, A. E., and Harris, R. S. Caries-producing effect of similar foods grown in different soil areas. New England J. Med. 244:361 March 8, 1951.

23. McClure, J. J., and Folk, J. E. Skim milk powders and experimental rat caries. Proc. Soc. Exper. Biol. & Med. 83:21 May 1953.

24. Hodge, H. C. Effect of age on incidence of experimental caries in normal and castrate female rats. J. D. Res. 22:275 Aug. 1943.

25. Braunschneider, G. E.; Hunt, H. R., and Hoppert, C. A. Influence of age in the development of dental caries in the rat. J. D. Res. 27:154 April 1948.

26. Shaw, J. H. Relation of tooth age to the caries-susceptibility in the albino rat. Unpublished data.

Volker[27] that the susceptibility to caries could be greatly increased in hamsters by transferring the animals to the high carbohydrate diets at birth rather than at weaning time as had been the customary procedure. The importance of the early period following tooth eruption has also been emphasized by the observation that caries susceptibility increased as the ages at which rats were deprived of their salivary glands decreased.[28] In other words, it may be suggested that the erupting teeth are subject to a certain aging process or maturation which might have an important bearing on future caries susceptibility. In this process the excessive intake of sugar and other refined carbohydrates may operate through more than one mechanism: (1) by a process of replacement, that is, by interfering with the normal intake of nutrients essential for normal maturation, fluorides and other trace elements included and (2) by retention on the tooth surfaces by interfering with the normal salivary relationship with the emerging teeth. Little is known about the latter mechanism, but a few fundamental observations related to this problem deserve mentioning.

SALIVARY-DENTAL INTERRELATIONSHIP

The reason that relatively little work has been done on the posteruptive maturation of the enamel is, presumably, that the enamel of erupting teeth appears completely calcified to clinical inspection and ordinary clinical roentgenographic examination. It has been suggested as a result of the application of newer tools of research, however, that this is not so. By the use of radioactive tracers, it has been demonstrated that there is a considerably higher permeability and uptake of certain ions within the enamel just prior to and during eruption than after the teeth have been in function for some time.[29] Secondly, electron-microscopic examination of calcifying enamel has revealed that certain regions of the enamel between the prisms appeared to be characterized by a relatively nonfibrillar, organic framework.[30] This observation suggests that the inorganic crystals had as yet not reached the full size of mature enamel.[31] Third, on examination of this structure with certain histochemical methods, it was apparent that the ability of the enamel to be stained decreased during the period of maturation. It would seem that certain submicroscopic regions are subject to secondary mineralization.[32]

In one experiment, groups of rats were fed a purified high sugar ration entirely by stomach tube whereas littermate controls were allowed to eat the same diet in the normal fashion.[33] The molar teeth of the tube-fed rats were relatively impervious to histological staining procedures. In contrast, the molar teeth of the rats which were allowed to eat the purified ration in the usual way were stained to some extent by the same histological procedures; when stained, they seemed approximately as immature as recently erupted teeth. The presence of the purified ration in the oral environment around the newly erupted teeth of these rats apparently had retarded or arrested the normal process of maturation. It seems possible that these changes are modified by the fluid-solid relationship between enamel and saliva. Failure in this relationship may account for the fact that removal of the salivary glands of

27. Volker, J. F. Some observations concerning dental caries production in the Syrian hamster. (Abst.) J. D. Res. 30:484 Aug. 1951.

28. Fanning, R. J.; Shaw, J. H., and Sognnaes, R. F. Salivary contribution to enamel maturation and caries resistance. J.A.D.A. 49:668 Dec. 1954.

29. Sognnaes, R. F., and Shaw, J. H. Salivary and pulpal contribution to the radiophosphorus uptake in enamel and dentin. J.A.D.A. 44:489 May 1952.

30. Sognnaes, R. F., and others. Electron microscopy of the enamel of teeth in various stages of development. J. D. Res. 31:85 Feb. 1952.

31. Scott, D. B., and others. Electron microscopy of mature human enamel. J. D. Res. 31:74 Feb. 1952.

32. Wislocki, G. G., and Sognnaes, R. F. Histochemical reactions of normal teeth. Am. J. Anat. 87:239 Sept. 1950.

33. Kite, O. W.; Shaw, J. H., and Sognnaes, R. F. Prevention of experimental tooth decay by tube-feeding. J. Nutrition 42:89 Sept. 1950.

animals at an early age, when the teeth are emerging into the oral cavity, is particularly prone to increase the future caries susceptibility. It is possible also that certain types of refined carbohydrates interfere with the interphase between the enamel and saliva. Exposure of the external tooth surface of rhesus monkeys to radioactive saliva shows a diminished radiophosphorus uptake when sugar is added to the saliva mixture.[29]

Saliva is a product dependent on many factors aside from those existing in the mouth itself. It would appear from the recent observations by Schwartz and Shaw[34] that the parotid secretion is particularly significant, since the selective surgical removal of the parotid glands resulted in the relatively highest caries incidence. The physical properties of saliva, rate of flow and washing effect of the serous parotid secretion would seem a logical explanation for these observations. This may not, however, be the complete explanation. Further work will be necessary in order to appraise the exact ingredients of saliva which result from different metabolic states, nutrition, hormonal function and so forth. The saliva may well play a very special role for the young enamel of the recently erupted teeth, a role which might be similar to that played by connective tissue fluid in relation to bone and other mesenchymal hard tissues.

That salivary glands not only serve a secretory function but also an excretory one is suggested by the rapid appearance of nonphysiological substances of such ions as iron and iodine in the salivary secretions. It should be recognized, therefore, that although normally the salivary secretions may serve a significant function in providing the proper ingredients for the young enamel of erupting teeth, they may conversely present to the tooth surface substances which normally do not belong there and, hence, may do more harm than good. Also, the extent to which the salivary secretions respond to such metabolic states as acidosis needs to be ascertained. It is known that in emergency states great quantities of certain ions, notably sodium, can be withdrawn from the bone into the extracellular fluid. Saliva may or may not be so protected that only severe metabolic disturbances will result in any comparable action on the adjacent hard tissue, the enamel.

SUMMARY

The development of the teeth is controlled to varying degrees by genetic, hormonal, nutritional and other systemic conditions and involves several stages: histodifferentiation, organic matrix formation, calcification, maturation, eruption and function. This report is concerned with nutritional studies with special reference to carbohydrates. In these studies the experimental variables have been introduced prior to eruption of the teeth. Various clinical and experimental observations indicate that the susceptibility to dental decay is influenced by nutritional factors which operate during the period of tooth development.

A remarkably high resistance to dental decay has been observed in rodents whose teeth have developed during subsistence on a stock diet composed of unpurified or natural food and in rhesus monkeys raised on the diet prevailing in their natural habitat, even if the animals were subsequently transferred to diets high in sugar and other carbohydrates.

The relative ratios of various nutrients, known and unknown, present in the diet and the bearing which these ratios have on the caries susceptibility appear to be significant fields of future research on caries as on other nutritional problems.

Studies on the significance of nutrition

34. Schwartz, A., and Shaw, J. H. Studies on the effect of selective desalivation on the dental caries incidence of albino rats. J. D. Res. 34:239 April 1955.

during the period of tooth eruption, maturation and function are complicated by the simultaneous influence of oral environmental factors; but observations are accumulating to support the theory that nutritional and other systemic factors may play a continuous role in determining the susceptibility to tooth decay through an effect on the teeth themselves.

There are several potential mechanisms whereby excessive consumption of sugar and other refined carbohydrates may affect caries resistance.

Effect of sugars and other carbohydrates on the oral flora

Ned B. Williams, D.D.S., Ph.D., Philadelphia

The oral flora is the most complex mixed culture of any area on or in the human body. It consists of large populations of different microorganisms (mostly bacteria) continuously metabolizing on all of the available surfaces in the oral cavity. The greatest concentration of microorganisms is usually found in and on the pits, fissures and smooth surfaces of the teeth. Photomicrographs or electron micrographs of sections of teeth through such regions show the heavy colonization.[1, 2]

Many kinds of bacteria may be cultivated regularly from the saliva and different regions in the healthy mouth; some examples of these kinds of bacteria are streptococci, fusobacteria, staphylococci, lactobacilli, pneumococci, diphtheroids, and gram-negative cocci and bacilli. The microbial content in saliva has been studied more frequently and in more detail than in specific mouth regions because of the ease with which it can be sampled and quantitated. Harrison[3] indicated that except for some variations in relative numbers there is little difference between the kinds of organisms in saliva and of those on tooth surfaces. Krasse[4] supported this view as far as lactobacilli are concerned, but reported that the ratio of streptococci is greater in saliva than in dental plaques. Thus the use of saliva samples as indicators of kinds and numbers of microorganisms in the oral flora seems to be justified as long as such samples are not used to measure specific microbial activities in particular regions of the mouth.

Specific interest in the role of oral microorganisms in the etiology of dental caries was intensified by the work and

Presented as part of a panel discussion "Effects of sugars and other carbohydrates on the teeth" before the Sections on Research, Pedodontics and Public Health Dentistry, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

School of Dentistry, University of Pennsylvania.

1. Boyle, P. E., editor. Kronfeld's Histopathology of the teeth and their surrounding structures, ed. 3. Philadelphia, Lea & Febiger, 1949, p. 125.

2. Scott, D. B., and Albright, J. T. Electron microscopy of carious enamel and dentine. Oral Surg., Oral Med. & Oral Path. 7:64 Jan. 1954.

3. Harrison, R. W. Lactobacilli versus streptococci in etiology of dental caries. J.A.D.A. 37:391 Oct. 1948.

4. Krasse, B. Proportional distribution of different types of streptococci in saliva and plaque material. Odont. Revy. 4:304, 1953.

writings of W. D. Miller. Although he indicated that acid by-products of microbial fermentation initiated the carious lesion, it has been only recently that microorganisms[5] and fermentable carbohydrates[5,6,7] (mostly natural and refined sugars) have been shown to have major roles in caries. The disintegration of fermentable carbohydrates by bacterial enzymes results in the production of acids which can affect tooth structure. Stephan[8] and others[9,10] have found that, under proper conditions, acid in sufficient potential to decalcify tooth structure is formed in the mouth on localized surfaces of the teeth. Furthermore, the rapidity and amount of acid formation is dependent on the kind, as well as the physical state,[11] of the fermentable carbohydrate in the oral cavity. Thus it has been established that oral microorganisms, carbohydrates and the resulting acids are essential for the primary disintegration of tooth surfaces. On the other hand, although these essentials are present and conditions appear to be favorable for caries, many other factors determine whether a typical carious lesion will develop: susceptibility of tooth structure, sugar clearance time, periodicity of exposure to carbohydrates and so forth.

CARBOHYDRATES AND MICROORGANISMS

The effect of carbohydrates on populations of bacteria in the oral cavity is not known completely. It is probable that carbohydrates in the concentration usually put into the mouth, do not directly affect the microorganisms. Thus any possible effect is dependent on how the microorganisms act on the carbohydrates. Carbohydrates are extremely important in the metabolic activities of the oral flora, as well as all other microorganisms: (1) they serve as the chief source of energy for cell functions and (2) they are the principal, if not the only, source of carbon for synthesis of cell substances. Monosaccharides such as glucose, disaccharides such as sucrose and fructose, and polysaccharides such as starch are intermittently available in the oral cavity from remnants of food or liquids. Polysaccharides other than starch are present continuously in the oral cavity, but since they are attached to proteins in mucin, dead tissue and bacterial cells, enzymatic hydrolysis is required to free them. Bacterial degradation of mucin (a mucopolysaccharide) and utilization of the by-products of the polysaccharide moiety, which includes glucose, have been described.[12,13]

Even though carbohydrates are available, the absence of other essential nutrients, proper enzymes and certain environmental factors will prevent or seriously hamper bacterial activity.[14,15] There is considerable evidence, however, that these necessary substances and conditions are nearly always at hand in the saliva;[16-20] thus the saliva is a suitable

5. Orland, F. J., and others. Use of germfree animal technic in study of experimental dental caries. I. Basic observations on rats reared free of all microorganisms. J. D. Res. 33:147 April 1954.

6. Volker, J. F. What is scope of knowledge of dental caries process? J. California D. A. 26:10 May-June (Supplement) 1950.

7. Hockett, R. C. Food and tooth decay. Sugar Molecule 6:4 Summer 1952.

8. Stephan, R. M. Changes in hydrogen-ion concentrations on tooth surfaces and in carious lesions. J.A.D.A. 27:718 May 1940.

9. Stralfors, A. Bacterial chemistry of dental plaques. Odont. Tskr. 58:155, 1950.

10. Fosdick, L. S.; Campaigne, E. E., and Fancher, O. E. Rate of acid formation in carious areas; the etiology of dental caries. Illinois D. J. 10:85 March 1941.

11. Bibby, B. G.; Goldberg, H. J. V., and Chen, E. Evaluation of caries-producing potentialities of various foodstuffs. J.A.D.A. 42:491 May 1951.

12. Rogers, H. J. Bacterial hydrolysis and utilization of polysaccharide-like substances ("mucin") in saliva. Nature, London 161:815 May 22, 1948.

13. Knox, K. W. Observations on action of mucolytic enzymes on salivary mucoid. J. D. Res. 32:374 June 1953.

14. Dreizen, S., and Spies, T. D. Observations on relationship between selected B vitamins and acid production by microorganisms associated with human dental caries. J. D. Res. 32:65 Feb. 1953.

15. Waring, G. W., Jr., and Weinstein, L. Studies on metabolism of Streptococcus pyogenes; oxygen consumption in presence of glucose and certain additional substances. J. Infect. Dis. 79:205 Nov.-Dec. 1946.

16. Williams, N. B. Saliva as a culture medium. D. Practitioner 3:265 May 1953.

17. Kauffman, S. L.; Kasai, G. J., and Koser, S. A. Amounts of folic acid and vitamin B_{12} in saliva. J. D. Res. 32:840 Dec. 1953.

culture medium for many bacteria. Amino acids, growth factors, trace elements and so forth apparently are derived primarily from local pabulum by the action of bacterial enzymes rather than from the blood stream through salivary gland secretions.

Kirch and co-workers[21] found that the concentrations of different amino acids in the saliva remained at fairly steady levels except for a temporary (30 to 60 minute) increase after eating. They noted the return to pre-eating levels even though the levels in the blood were still elevated.

Orland, Hemmens and Harrison[22] deleted essential growth factors from the cariogenic rations offered to hamsters, but supplied these chemicals parenterally. The conditions in the oral cavity, at least in regard to caries incidence, were altered so that definite changes occurred; for example, the deletion of nicotinic acid (an essential nutrilite for many bacteria) was accompanied by a significant reduction in caries incidence. Thus nicotinic acid was not available in the oral cavities of these animals to the same extent as it was in the mouths of the controls. Although the available evidence seems to indicate that the oral flora can be affected more easily by local than by systemic factors, there are too few direct studies for a conclusion.

Carbohydrates may affect the populations in the oral flora in various ways. If it is assumed that a particular carbohydrate can be utilized by one group of bacteria (A) but not by a second group (B), the following could occur:

1. A has a detrimental effect on B.
   a. A may increase in number and "crowd out" B, possibly by the depletion of nutrients, or a change in redox potential and so forth.
   b. The metabolic products of A may inhibit B, perhaps by interference with one or more essential processes.
2. A has a beneficial effect on B.
   a. Group A produces metabolites useful to B.
   b. Action of A creates environmental conditions, such as anaerobiosis or a favorable pH potential and so forth, which allow B to increase in metabolic activity and number.
3. There is no effect of one on the other.

The effect of penicillin, introduced into the oral cavity by topical[23] or parenteral application,[24] on oral bacteria serves as a good example of how the populations of the oral flora can be altered. *Streptococcus salivarius* is numerous in the saliva before the application of penicillin, whereas gram-negative bacilli are relatively few, or none may be cultivable. Penicillin applied topically[23] in proper concentration reduces the number of *Str. salivarius,* and gram-negative bacilli almost simultaneously increase in number or become cultivable. The discontinuation of penicillin is followed by a restoration of the relation between these populations. It is conceivable that continuous introduction of carbohydrates into the oral cavity could affect the ratio of certain populations but in a much more indirect manner than the use of penicillin.

The rapidity and extent of carbohydrate degradation to acids by bacterial

18. Dreizen, S., and others. Amino acid requirements of oral acidogenic microorganisms associated with human dental caries. J. D. Res. 33:339 June 1954.

19. Hill, T. J., and Kneisner, A. H. Nutritional requirements of oral lactobacilli. I. Pantothenic acid and dextrose (d-glucose). J. D. Res. 21:467 Oct. 1942.

20. Chauncey, H. H., and others. Enzymes of human saliva. I. Determination, distribution and origin of whole saliva enzymes. J. D. Res. 33:321 June 1954.

21. Kirch, E. R., and others. Influence of ingestion of single amino acids on level of free amino acids in human saliva. J. D. Res. 32:57 Feb. 1953.

22. Orland, F. J.; Hemmens, E. S., and Harrison, R. W. Effect of partly synthetic diets on dental caries incidence in Syrian hamsters. J. D. Res. 29:512 Aug. 1950.

23. Williams, N. B.; Eickenberg, C. F., and Oshtry, Doris. Changes in relative proportions of oral bacteria during topical application of penicillin. (Abst.) J. D. Res. 33:689 Oct. 1954.

24. Long, D. A. Effect of penicillin on bacterial flora of the mouth. Brit. M. J. 2:819 Nov. 22, 1947.

enzymes depends on the concentration and kinds of bacteria and carbohydrates, as well as different environmental conditions. Pyruvate is a common precursor of several kinds of products of fermentation; thus the differences between various bacteria may be found in the fate of the pyruvate. Some bacteria, such as the homofermentative lactobacilli, reduce pyruvate to high yields of lactic acid, whereas others, such as the heterofermentative lactobacilli, form lactic acid in low yield and several other products. Still other bacteria can convert pyruvate and also lactate to carbon dioxide and water. These various kinds of bacteria are known to be present in the oral cavity, and lactic as well as some other acids (the amounts depend on the oxygen tension[25] of the mixtures) are produced by oral bacteria in, as well as out of, the mouth.[26, 27] Stephan and Hemmens,[28] who worked with concentrations of oral bacteria such as those in the mouth, found the following: (1) when the concentration of glucose was varied, different strains of oral bacteria produced different amounts of acid and (2) when a high concentration of glucose was available, acid production was somewhat faster and lasted longer. In general there was more acid produced from monosaccharides and disaccharides than from starch, but there were individual differences between the monosaccharides and disaccharides.

The production of acid depends to a great extent on the amount of fermentable carbohydrate and its persistence in the oral cavity. When carbohydrate solutions are placed in the mouth there is a rapid production of acids, which results in an increase in the hydrogen ion concentration in bacterial plaques[8-10] and saliva.[29, 30] Reductions in the hydrogen ion concentration occur at a variable rate, usually being more rapid in saliva than in the plaque and depending on the kind of carbohydrate, the concentration and time of retention,[6, 9, 31, 32] the acid neutralizing capacity of saliva[32, 33] or plaque,[9] the effect of bacteria on the acids[34, 35] and so forth.

The hydrogen ion concentration of the medium or environment can affect the viability of certain bacterial populations, whereas others can easily adapt to fluctuations in the pH of the environment. Dubos[36] reported that pyruvate as well as products of pyruvate metabolism have a bactericidal effect on staphylococci and tubercle bacilli at an acid pH. Many workers have noted that the growth of streptococci and pneumococci can be increased if the culture medium is buffered or made alkaline to neutralize the acid by-products of glycolysis and thereby prevent their antibacterial effect. The number of viridans streptococci, cultivable from saliva of healthy humans, is higher than the number of many other bacteria. This fact suggests that any acid pH in the oral cavity has little effect on the total number of these organisms.

Although the incidence of pneumococci in the saliva of healthy humans is

25. Kantorowicz, B., and Birman, O. Acid production in saliva in relation to air contact. J. D. Res. 32:601 Oct. 1953.

26. Neuwirth, I., and Summerson, W. H. Production of acids from glucose by oral micro-organisms: lactic and pyruvic acids. J. D. Res. 30:100 Feb. 1951.

27. Muntz, J. A. Production of acids from glucose by dental plaque material. J. Biol. Chem. 148:225 April 1943.

28. Stephan, R. M., and Hemmens, E. S. Studies of changes in pH produced by pure cultures of oral micro-organisms. J. D. Res. 26:25 Feb. 1947.

29. Hartles, R. L., and McLean, N. D. Note on rapidity of production and removal of lactic acid following introduction of 10 per cent glucose solution into the mouth. Brit. D. J. 95:63 Aug. 4, 1953.

30. Haggard, H. W., and Greenberg, L. A. Acidity of saliva after ingestion of carbohydrate and acid-containing substances. J. D. Res. 30:126 Feb. 1951.

31. Volker, J. F., and Pinkerton, D. M. Factors influencing oral glucose clearance. J. D. Res. 26:225 June 1947.

32. Lundquist, C. Oral sugar clearance. Its influence on dental caries activity. Odont. Revy. 3:suppl. 1, 1952.

33. Dreizen, S., and others. Buffer capacity of saliva as measure of dental caries activity. J. D. Res. 25:213 Aug. 1946.

34. Neuwirth, I., and Summerson, W. H. Utilization of lactic and pyruvic acids by oral microorganisms. (Abst.) J. D. Res. 21:241 April 1942.

35. Douglas, H. C. On occurrence of lactate fermenting anaerobe Micrococcus lactilyticus in human saliva. J. D. Res. 29:304 June 1950.

36. Dubos, R. J. Effect of ketone bodies and other metabolites on survival and multiplication of staphylococci and tubercle bacilli. J. Exper. Med. 98:145 Aug. 1953.

high,[37] little is known about the relative number of pneumococci in saliva or the effect of an acid pH on oral strains. The pH of saliva has an influence on the incidence of yeasts; the lower the pH the higher the incidence.[38] A low incidence of yeasts in saliva is found, however, when there is a high incidence of lactobacilli and enterococci in saliva.[39] Ordinarily there is a relatively rapid dissipation of acids in the oral cavity;[9,29] therefore, the increase in hydrogen ion concentration in the presence of fermentable carbohydrates is not likely to affect seriously the bacterial populations.

It is conceivable that, if an acid pH is maintained for a fair period or recurs at frequent intervals in the region of a plaque because of the presence of fermentable carbohydrate, the populations of bacteria in the plaque and eventually in the saliva might be altered. Acidophilic and aciduric organisms would tend to flourish and might affect other populations. Increased metabolic activity and improvement in environmental conditions might lead to changes in the metabolic capacity of the bacteria; for example, Weisberger[40] found that a strain of lactobacillus which required tryptophan would not grow in saliva; if glucose was added, however, growth resulted. Presumably the presence of glucose enabled the lactobacillus to use tryptophan from sources not previously available. Higher proportions of particular organisms eventually might be found in saliva samples if conditions such as those stated continued for a period of time.

CARBOHYDRATES AND LACTOBACILLI

These conditions might be the basis for the reported relation between the ingestion of fermentable carbohydrates and relatively high lactobacillus counts in saliva.[41-43] It should be emphasized that the lactobacilli are not the only acidophilic, aciduric and acidogenic bacteria in the oral flora. Other populations may also increase or decrease, but workers either have not looked for or have not developed methods to detect such changes. Reports of reductions in the lactobacillus counts after restriction of carbohydrates in the diet[44-46] are indirect evidence that carbohydrates affect the lactobacillus population. Jay[44] indicated that the restriction of carbohydrate might beneficially affect other bacterial populations and result in an antagonism to lactobacilli, since the reintroduction of carbohydrates into the mouth does not lead to an increase in lactobacilli. Howitt and Fleming[41] also noted a reduction in aciduric forms when a high protein diet was used, but they did not find an increase in proteolytic forms.

Jay[44] suggested that the change in lactobacillus populations associated with the reduction in carbohydrate consumption could be due to inhibition of lactobacilli by metabolic products of *Aerobacter aerogenes* as described by Kesel and coworkers.[47] The latter workers found that

37. Williams, N. B.; Appleton, J. L. T., and Polevitsky, K. Interrelationships among microbic populations of oral, pharyngeal and nasal regions of human beings. Bact. Proc. 52:129 April 1952.

38. Young, G.; Resca, H. G., and Sullivan, M. T. Yeasts of the normal mouth and their relation to salivary acidity. J. D. Res. 30:426 June 1951.

39. Williams, N. B., and others. Study of simultaneous occurrence of enterococci, lactobacilli and yeasts in saliva from human beings. J. D. Res. 29:563 Oct. 1950.

40. Weisberger, D. Role of glucose in promoting growth of lactobacilli in saliva. Science 105:290 March 14, 1947.

41. Howitt, B. F., and Fleming, W. C. Quantitative examination of mouth flora under different dietary conditions. J. D. Res. 10:33 Feb. 1930.

42. Jay, P., and others. Observations on relationship of Lactobacillus acidophilus to dental caries in children during experimental feeding of candy. J.A.D.A. 23:846 May 1936.

43. Hafstader, R. D., and others. Effect of a selected nitrofuran, Furacin, on oral lactobacillus count. J. D. Res. 29:794 Dec. 1950.

44. Jay, P. Effect of substrate on oral flora. J.A.D.A. 37:416 Oct. 1948.

45. Becks, H. Physical consistency of food and refined carbohydrate restrictions—their effect on caries. J. D. Res. 27:405 June 1948.

46. Kitchin, P. C., and Permar, D. Results of three-year study of effectiveness of carbohydrate restriction in reducing salivary lactobacillus counts. J. D. Res. 27:316 June 1948.

47. Kesel, R. G., and others. Biological production and therapeutic use of ammonia in oral cavity in relation to dental caries prevention. J.A.D.A. 33:695 June 1946.

ammonia, in salts of ammonia, produced by deamination of amino acids *in vitro* by *A. aerogenes* in the oral flora could inhibit lactobacilli. Pearlman,[48] however, reported that salts of ammonia were not inhibitory *in vitro* to a lactobacillus strain, and in studies of mixed cultures *in vitro* White and Hill[49] could not observe any antagonistic effects of a strain of *A. aerogenes* on a lactobacillus strain. Williams, Eickenberg and Oshtry[28] indicated that for several days, during and after topical application of penicillin, the relative number of gram-negative bacilli (many being *A. aerogenes*) remained significantly higher than the number of lactobacilli. No reduction in number, however, was evident; if anything, a slight increase was noted. It is likely, as with many other microbial activities in the mouth, that a single factor does not always account for particular observations because of the probability of "chain reactions" in response to any alteration of the oral environment or the ratio of microorganisms.

Recently there was an opportunity to make counts on lactobacilli, *Streptococcus salivarius* and gram-negative bacilli in samples of saliva from three volunteers (A, B, and C) who consumed sucrose in addition to their usual diet. Saliva samples were obtained "on arising" for five consecutive days, and counts were made on these samples for base line data. Introduction of 5.4 ± 0.3 Gm. of sucrose, in the form of a lump, was started 24 hours before the next saliva sample was obtained. The sucrose was placed in the mouth and was allowed to dissolve; this procedure was not followed by rinsing or toothbrushing. The sucrose was consumed six times daily after meals, between meals and before bedtime; thus a total of 32 Gm. of sucrose was consumed in addition to the usual diet each day.

Analysis of the data indicated slight changes in the ratio of lactobacilli and gram-negative bacilli, but no changes in the ratio of *Str. salivarius*. The counts from the saliva samples of Subject A were higher for lactobacilli and lower for gram-negative bacilli while sucrose was being consumed. The lactobacillus counts from samples from Subject B did not change, but the counts for gram-negative bacilli were lower during the use of sucrose. No changes were observed for Subject C. It was found that fairly large amounts of carbohydrate were consumed during the entire period, so that the addition of 32 Gm. of sucrose amounted to a very small proportion of the total daily intake of carbohydrate. Thus, if fermentable carbohydrate affects the oral flora, the conditions in the oral cavities of these subjects were not conducive to alterations in the ratios of the bacteria cultured. It is probably safe to say that diet affects the oral flora, but what substances affect what microorganisms and how they affect them is an area of study that has been badly neglected.

INDIRECT EFFECTS OF CARBOHYDRATES

Although the studies described earlier are the main reports on changes in the oral flora associated with the presence or absence of carbohydrate, there are some studies indirectly associated with carbohydrate consumption that are worth reviewing. Kniesner, Mann and Spies[50] reported that the number of lactobacilli was low in saliva samples from patients with vitamin deficiencies. The diet was high in carbohydrates, and the saliva contained adequate amounts of pantothenic acid for the growth of lactobacilli. It is not certain whether the absence of essential nutrients in the diet was responsible

48. Pearlman, S. Action of ammonia salts on Lactobacillus acidolphilus (4646). (Abst.) J. D. Res. 28:638 Dec. 1949.

49. White, B. J., and Hill, T. J. Antagonistic relationship between oral organisms. J. D. Res. 28:272 June 1949.

50. Kniesner, A. H.; Mann, A. W., and Spies, T. D. Relationship of dental caries to deficiencies of vitamin group. J. D. Res. 21:259 June 1942.

for the relatively small lactobacillus populations in the oral cavity. A study of cultures from the mouths of hamsters has indicated that the vitamin content of the diet has little to do with the number of aciduric bacteria.[51]

Hemmens and co-workers[52] observed the incidence of many types of bacteria in dental plaques obtained at intervals before and after a carious lesion developed in a tooth. They found that lactobacilli could be isolated in higher incidence than other bacteria just before and after the carious lesion became detectable clinically. Thus the population of lactobacilli in the plaques must have increased, but samples of saliva were not cultured to determine whether there were changes in the number of cultivable lactobacilli before, during or after the change in incidence in the plaques. Clement and Rae[53] cultured saliva of caries-resistant African natives whose diet contained few refined foodstuffs. The lactobacilli isolated were all heterofermenters (relatively "weak" acid formers[54]). Workers in this country[55, 56] have reported that homofermentative lactobacilli ("strong" acid producers) predominate in most saliva samples. Tilden and Svec[55] indicated that homofermenters were more likely to give a 4 plus reaction in 24 to 48 hours in Synder's medium than heterofermenters. When colony counts were made for the two kinds of lactobacilli, the counts indicated that homofermenters predominated in saliva samples from patients with high lactobacillus counts (indicating oral conditions are conducive to caries activity).[57] These data tend to support the concept of an association of particular kinds of lactobacilli with the presence or absence of dental caries.[58]

SUMMARY

1. The oral flora consists of many different microbial populations whose relative numbers differ in the several regions of the oral cavity. The most heavily populated area is the interproximal tooth surface.

2. Microorganisms and carbohydrates are essential in caries; the acid by-products of microbial glycolysis are associated with an alteration in tooth enamel.

3. The kinds of carbohydrates, their concentration, physical state and periodicity of ingestion can affect the oral flora, but direct evidence is very limited.

4. The lactobacillus population is the only one in the oral flora which has been studied in any detail during changes in dietary carbohydrate.

5. The interrelationships of oral microorganisms under various oral conditions established by local or systemic means are fertile areas for investigation.

51. Orland, F. J. Oral bacterial flora as related to dental caries in Syrian hamster. J. D. Res. 26:455 Dec. 1946.

52. Hemmens, E. S., and others. Microbic flora of dental plaque in relation to beginning of caries. J. D. Res. 25:195 Aug. 1946.

53. Clement, A. J., and Rae, W. Field studies in the Southern Kalahari, August 1951. III. Bacteriological investigation of saliva of various Bakalagadi school children and Bushmen. J. D. A. South Africa 8:64 Feb. 1953.

54. Sullivan, H. R.; Still, J. L., and Goldsworthy, N. E. Acid production as basis for classifying lactobacilli from carious teeth. J. D. Res. 18:513 Dec. 1939.

55. Tilden, E. B., and Svec, M. Further studies of differential culture technique for estimations of acidogenic bacteria in saliva. J. D. Res. 31:831 Dec. 1952.

56. Rogosa, M., and others. Species differentiation of oral lactobacilli from man including descriptions of Lactobacillus salivarius nov. spec. and Lactobacillus cellobiosus nov. spec. J. Bact. 65:681 June 1953.

57. Williams, N. B. Unpublished.

58. Clapper, W. E., and Heatherman, M. E. Strain differences in oral lactobacilli and relation to dental caries. J. Bact. 58:261 Aug. 1949.

Relation of oral biochemistry of sugars to the development of caries

J. F. Volker, D.D.S., Birmingham, Ala.

Although scientists' knowledge of the etiology of dental caries is fragmentary, there is general agreement that the minimal oral conditions that must be fulfilled before the initial carious lesion may be anticipated are twofold; namely, the presence of microorganisms and fermentable carbohydrates. Accordingly, it is important to review the knowledge concerning the oral physiology and biochemistry of sugars and allied substances.

The work herein reported is limited to that of the author and his associates.[1-3] It is not to be inferred that the observations and conclusions are original with us; rather, they are in agreement with and supplementary to those of many other investigators. It is only by dovetailing data from a variety of sources that the pertinent body of knowledge is established. A further limitation of this presentation is that it concerns itself exclusively with *in vitro* and *in vivo* observations with human subjects and materials. This does not mean that the vast amount of information accumulated from animal investigations is unimportant, but rather that it is beyond the scope of this paper. Parallel animal studies from these laboratories have been reported in detail elsewhere.[4]

The presence of sugars in and about the teeth is explainable on the basis either of their adhering to the teeth during the act of digestion or their being secreted into the oral cavity as a normal constituent of the saliva. It is, therefore, important to ascertain whether the salivary glands normally secrete sugar in significant quantities. It is not unusual in surveying the older literature to find statements supporting the view that saliva normally contains appreciable quantities of sugar and that these values are further increased during certain pathologic states as, for example, diabetes. In all probability, these beliefs may be explained by the nonspecific nature of biochemical methods available to early research workers for the detection of sugars. Virtually all of the present investigators active in the field are in agreement that the quantity of sugar secreted in the saliva is negligible.

Presented as part of a panel discussion "Effects of sugars and other carbohydrates on the teeth" before the Sections on Research, Pedodontics and Public Health Dentistry, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

Dean, University of Alabama School of Dentistry.

1. Volker, J. F., and Pinkerton, D. M. Some observations on the clearance of glucose from the oral cavity. J. D. Res. 26:9 Feb 1947.

2. Volker, J. F., and Pinkerton, D. M. Factors influencing oral glucose clearance J. D. Res. 26:225 June 1947.

3. Volker, J. F., and Pinkerton, D. M. Acid production in saliva-carbohydrate mixtures. J. D. Res. 26:229 June 1947.

4. Finn, S. B.; Klapper, C. E., and Volker, J. F. Intra-oral effects upon experimental hamster caries. In Advances in experimental caries research, R. F. Sognnaes, editor. Washington, D. C., American Association for the Advancement of Science, 1955, p. 152-168.

Table 1 • Daily glucose* variation

Subject	1st day†	2nd day	3rd day	4th day	5th day	Av.
1	15	11	14	32	23	19
2	20	16	14	8	15	14
3	20	23	19	32	10	21
4	17	22	23	21	15	19
5	17	15	16	40	11	20
6	20	9	21	16	16	16
7	21	11	11	15	26	17
8	23	8	32	25	23	22
9	19	21	23	16	13	18
10	18	22	28	18	13	20
11	16	20	25	33	18	22
12	19	12	26	18	14	18

*Reducing substances calculated as glucose.
†All values are mg. %.

GLUCOSE LEVELS IN SALIVA

The author has studied the normal salivary glucose level of 12 subjects over a period of six days. When samples were taken two hours after eating, values which ranged from 14 to 22 mg. per cent were found. He concurs with other workers that most, if not all, of this value is attributable to reducing substances other than glucose. These data may be seen in Table 1.

In addition to the observations on normal persons, the possibility of a divergent observation in diabetic children has been considered. From a consideration of the data accumulated in many laboratories, including ours at the University of Alabama, it may be concluded that there is no appreciable elevation of salivary sugar in persons afflicted with this condition. It might, therefore, be said that analyses of saliva two hours after eating reveal negligible quantities of glucose and that there is no evidence that the normal value is profoundly influenced by physiologic or pathologic states. In making this statement it should be remembered that glycoproteins are normal constituents of saliva and that hydrolysis of these materials could influence the salivary sugar concentration. This possibility is in need of further study before its importance can be assayed.

It is probable that some of the conflicting reports found in the early literature regarding the presence of sugar in the saliva are attributable to a lack of understanding of the normal oral clearance mechanism of sugars. Those investigators who took samples immediately after the ingestion of meals found high sugar values. Those making analyses several hours after eating found none. These divergent conclusions may be reconciled in the light of more recent studies wherein salivary glucose levels have been determined before eating and at stated intervals after the ingestion of food and confections. In the laboratory at the University of Alabama School of Dentistry, the glucose concentration of saliva before and after the chewing of gum and the eating of hard and soft mints, chewy candies, cookies and bread and jam has been observed. These observations are reported in Table 2. It will be noted that although the pre-eating sample has minimal glucose, it is not unusual for concentrations in excess of 500 mg. per cent to occur in the mouth after the eating of typical snacks.

Subsequently, these studies were extended to include the salivary clearance of glucose after the ingestion of an Army field ration. This was done because we were interested in observing the variations in salivary sugar levels with something more complex than a snack. The Army field ration offered the opportunity of accumulating data on a standardized meal containing sugars and allied substances in the form of hard biscuit, flavored drink and candy. The data for three test subjects are presented in Table 3. From these observations it may be concluded that it is possible to maintain high salivary glucose levels for an hour and a half merely by ingesting a meal containing sugars and allied substances in a variety of physical forms.

In reviewing these data, we were particularly concerned with the high salivary glucose values during and after the

Table 2 • Glucose* concentration of human saliva after use of food and confections

Substance	No. subjects	Time of eating in min.	Av. glucose concentration in mg. %			
			0 time†	5 min.‡	15 min.‡	30 min.‡
Chewing gum, Dentyne, 3.2 Gm.	28	30 (chewing)	19	484	147	26
Soft mint, Birch Bit, 2.5 Gm.	12	4	16	662	131	23
Hard mint, Toronto Mint, 1.9 Gm.	12	9 (av.)	21	377	259	24
Chewy candy, Chocletto, 5.9 Gm.	11	7	24	1,909	269	26
Cookie, vanilla wafer, 8.2 Gm.	12	2.5	16	889	117	18
Bread and jam, 76.0 Gm.	12	3	25	1,475	149	22

*Reducing substances in saliva calculated as glucose.
†Zero time value is control value taken immediately before beginning the ingestion of the test substances.
‡Time intervening since the beginning of ingestion of the test substances.

ingestion of the hard candy taken at the end of the field ration meal. In order that we might study this further, a group of four subjects volunteered to suck lollypops. The data accumulated in this experiment may be seen in Table 4. It is apparent that the ingestion of certain confections as exemplified by the lollypop makes for a considerable and prolonged elevation in the salivary glucose level. It is of great importance that the oral clearance of representative sugar-containing food continues to be studied, and it is most fortunate that this problem has received the continuing interest of competent researchers, including Bibby[5] and Lundqvist[6] and their associates.

The variations in the preliminary studies pointed to the need for expanding the knowledge of the factors influencing the clearance of oral glucose. Although the importance of the rate of salivary flow, the morphology of the dental arches and the action of the muscles of mastication was recognized, an investigation of these factors has been deferred until after the role of the physical nature of the sugar supplement and the manner in which it is consumed has been studied in more detail.

Six young adults were utilized as test subjects, and salivary samples were taken before and at stated intervals after the ingestion by eating, sucking, drinking and chewing of 500 mg. quantities of glucose. These observations are presented in Table 5. It may be concluded that the clearance of the sugar is obviously dependent on

5. Bibby, B. G.; Goldberg, H. J. V., and Chen, E. Evaluation of caries-producing potentialities of various foodstuffs. J.A.D.A. 42:491 May 1951.

6. Lundqvist, C. E. Oral sugar clearance; its influence on dental caries activity. Odont. Revy 3:suppl. 1, 1952.

Table 3 • Clearance from oral cavity of glucose* contained in Army field ration

Subject	Beginning of ingestion period	Halfway through biscuits and drink	10 min. after biscuits and drink	Halfway through candy	10 min. after candy
A	47 (0)†	1,920 (13.5)	300 (41)	2,480 (58)	255 (90)
B	28 (0)	700 (10.5)	145 (33.5)	1,480 (55)	325 (83)
C	30 (0)	1,100 (8)	365 (26)	3,480 (53)	300 (82)

*Reducing substances in saliva calculated as glucose. All glucose concentrations are recorded as mg. %.
†Values in parenthesis represent time elapsed in minutes from the beginning of the ingestion period.

Table 4 • Clearance from the oral cavity of glucose* (mg. %) contained in lollypops

Subject	0 time	15 min.	30 min.	1 hr.	2 hr.
A†	27	6,160	3,840	245	72
B	23	700	1,290	870	47
C	22	1,290	5,160	2,440	54
D	21	4,320	6,160	1,060	64

*Reducing substances in saliva calculated as glucose.
†Subject consumed candy in approximately one hour. Others needed between one and one-quarter hours.

the physical form in which it is fed and that the quantity of sugar is of secondary importance.

CONVERSION OF SUCROSE TO GLUCOSE

All the data reported in the foregoing experiments are based on analyses of saliva for glucose. This has been done because the methods available for detecting this sugar are well established and because it is assumed with reservations that other cariogenic substances, particularly the polysaccharide starch and the disaccharide sucrose, must be hydrolyzed to six-carbon reducing sugars before they are of importance in caries etiology. Obviously, many of the experimental snacks and meals contained starch and sucrose, and it seems logical to expect that they contribute in part to the glucose salivary levels. The oral hydrolysis of starch to glucose has been studied in considerable detail, but little is known of the ability of sucrose to be hydrolyzed by oral enzymes. In an effort to extend our knowledge of this phenomenon, we have studied the *in vitro* and *in vivo* abilities of saliva to convert sucrose to glucose. It has been found that if 1 per cent sucrose is added to 10 cc. of saliva, the glucose concentration of the mixture increases from a control value of 15 mg. per cent to 70 mg. per cent within two minutes. If the sucrose concentration of the saliva is increased to 10 per cent, the two minutes' glucose concentration is increased to 200 mg. per cent or more. These data are shown in Figure 1.

The *in vitro* experiments have been supplemented by limited *in vivo* observations. A small group of human subjects volunteered to ingest 1 Gm. portions of a ration previously shown to be cariogenic in the Syrian hamster. This ration had 5 per cent sucrose but no glucose. Beginning at two minutes after the ingestion of the diet and continuing through 16 minutes at two-minute intervals, determination of the salivary concentration of actual and potential glucose was made. (The term potential glucose represents sucrose present in the saliva that could be converted to reducing substances.) The results of the *in vivo* experiments were found to parallel the results of the *in vitro* experiments; namely, that within two minutes there appeared in the saliva amounts of glucose in excess of 100 mg. per cent. These data may be seen in Figure 2.

After a consideration of the results, it has been concluded that appreciable quantities of dietary sucrose are converted to reducing sugars almost immediately on contact with certain enzymes normally present in the saliva or salivary microorganisms. It has been concluded further that the salivary glucose deter-

Table 5 • Amount (mg.%) of glucose* in saliva before, during and after use of 500 mg. glucose

How used	Time in minutes				
	0	2	9	16	30
Eaten (cake)†	18	1,425	68	20	14
Sucked (wafer)	18	3,304	1,860	1,125	229‡
Rinsed (solution)§	21	832	105	25	17
Chewed (gum base)‖	23	725	204	144	27

*Reducing substances in saliva calculated as glucose.
†The glucose cake (cube) was eaten within 1 minute.
‡Three of the six subjects had not completely dissolved their wafer. The 30 minute average value for those dissolving the wafer was 91 mg. per cent.
§The glucose solution of 4 cc. was rinsed in the mouth for one minute prior to swallowing.
‖The glucose in the gum base was chewed for the entire experimental period.

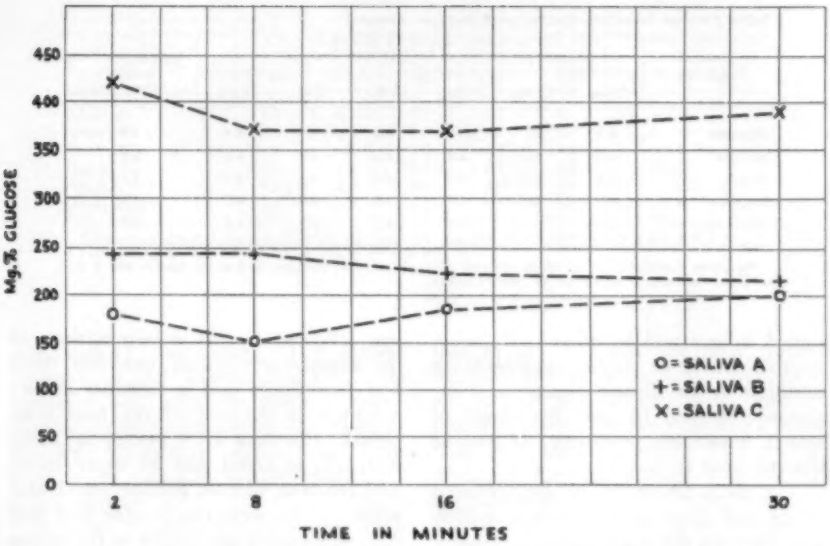


Fig. 1 • Glucose formation in saliva-sucrose mixtures (10 cc. saliva with 10 per cent sucrose). Term glucose represents reducing substances in saliva calculated as glucose. There is a possibility that some of the glucose formed could not be detected because it was broken down by microbial fermentation

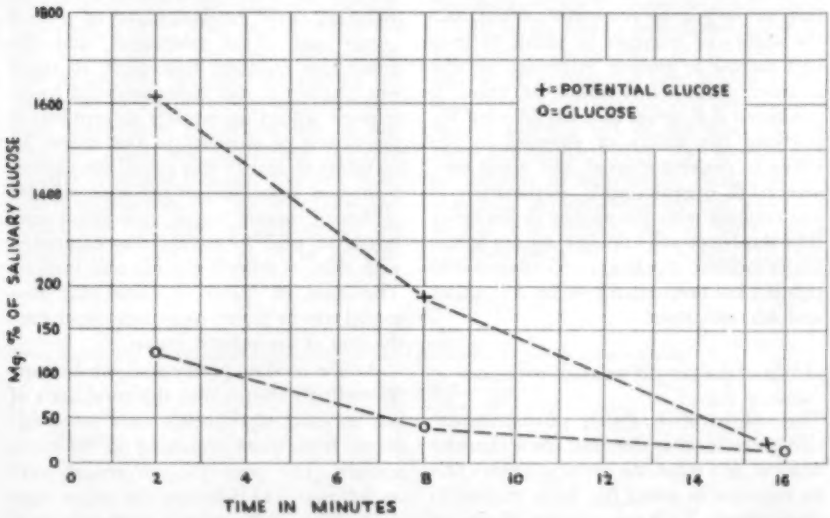


Fig. 2 • In vivo salivary sucrose to glucose conversion after ingestion of 1 Gm. 5 per cent sucrose ration. Values for glucose and potential glucose include fructose whose reducing equivalent has been calculated as glucose. There is a possibility that some of the glucose formed could not be detected because it was broken down by microbial fermentation

Table 6 • Acid formation in saliva-carbohydrate mixtures*

Substrate	pH of mixture at various time intervals						Terminal titratable acidity cc./0.025 N acid
	0 min.	30 min.	1 hr.	2 hr.	3 hr.	4 hr.	
Glucose	6.8	5.7	5.0	4.5	4.4	4.4	5.8
Sucrose	6.8	5.7	5.0	4.5	4.4	4.4	5.8
Starch	6.8	5.2	4.7	4.5	4.4	4.4	7.1
Fructose	6.9	5.5	4.9	4.6	4.4	4.3	6.0
White dextrin	6.8	6.1	5.0	4.5	4.3	4.3	5.3

*Mixtures contained 2.5 cc. of 10 per cent glucose, sucrose, fructose, and white dextrin and 5 cc. of 5 per cent starch plus 5 cc. of pooled saliva.

mined in our and in other oral carbohydrate clearance studies represents, in addition to the dietary glucose and the glucose formed by the hydrolysis of starch, a variable percentage of glucose derived from sucrose.

The data presented in the previous tables and illustrations throw considerable light on the normal glucose content of saliva as it is secreted by the glands, the extent and persistence of glucose in the saliva after test meals, the relation of the physical nature of the glucose-containing food to the glucose retention pattern, and the ability of enzymes in saliva to convert sucrose to glucose. Although all this is worthwhile information, its value is enhanced if it serves as a background for studying the ability of enzymes in the saliva to convert glucose and allied substances to organic acids, particularly if one concurs with the author in his belief that the latter are etiologic agents in the caries process. Such a continuing investigation has been attempted by the author and his associates.

CONVERSION OF SUGARS TO ACIDS

The comparative ability of representative monosaccharides and disaccharides to serve as a substrate for acid production by enzymes in saliva has been studied in some detail. To 5 cc. aliquots of pooled saliva from caries-active patients were added 2.5 cc. of comparable solutions of the test carbohydrates. Acid formation was followed by pH determinations of the mixtures at one-half, one, two, three and four hours and a terminal acidity recorded at the end of the four hour period. The data are reported in Table 6. It will be noted that the observations with fructose, sucrose, glucose, starch and white dextrin were comparable and that each was readily susceptible to the action of those enzymes in the saliva associated with acid production.

In subjecting these data to self-criticism, it was noted that each of the test materials could be designated as refined sugars and allied substances, and the immediate question that came to mind was whether or not their unrefined counterparts would be equally susceptible to the action of enzymes in the saliva. In an effort to clarify this point, the experiment was repeated and the susceptibility of honey, maple sugar, raw sugar and farina to acid formation was compared with that of refined glucose and sucrose. The data in Table 7 show that raw sugars are as prone to support acid production as are refined sugars.

As the studies progressed, we became increasingly aware that the conditions of our *in vitro* experiments were quite different from those occurring on the tooth surface. The principal differences were as follows: (1) whereas the sugar concentrations in the mouth ranged from as little as 15 mg. per cent to greater than 10,000 mg. per cent, in the test tube mixtures, the concentrations were con-

Table 7 • Acid formation in saliva-carbohydrate mixtures*

Substrate	pH of mixture at various time intervals					Terminal titratable acidity cc./0.025 N acid
	0 min.	30 min.	1 hr.	2 hr.	3 hr.	
Glucose	6.8	6.1	5.3	4.6	4.4	4.3
Sucrose	6.9	6.3	5.6	4.7	4.4	4.0
Starch	6.9	6.3	5.5	4.6	4.4	5.9
Farina	6.8	6.0	5.5	4.7	4.4	6.3
Honey	7.0	6.5	5.9	4.8	4.6	4.0
Maple sugar	7.0	6.2	5.5	4.7	4.5	4.7

*Mixtures contained 2.5 cc. of 10 per cent glucose, sucrose, honey and maple sugar and 5 cc. of 5 per cent starch and farina plus 5 cc. of pooled saliva.

stant and (2) the concentration of oral enzymes in our saliva-sugar test tube mixtures was probably minimal when compared to conditions found in dental plaques. Accordingly, experiments were designed to reconcile partially the differences referred to.

To 5 cc. aqueous solutions containing 0 to 10,000 mg. per cent of glucose and sucrose were added 5 cc. aliquots of saliva from caries-active persons. Acid production of the mixture was followed by the recording of the pH every 30 minutes over a three hour period. After the last pH reading, the titratable acidity was measured. Typical observations are presented in Table 8. It is apparent that acid production is comparable in the 100, 500, 1,000 and 10,000 mg. per cent glucose solutions through the first hour and is comparable for the 500, 1,000 and 10,000 mg. per cent of glucose for the entire three hour period. Acid production in the 100 mg. per cent glucose solution ceased after one hour, and analyses of the saliva-glucose mixture indicated that all of the available glucose had been utilized within that period. Although the observations with sucrose are not recorded in the table, they are almost identical with those of glucose.

The probable influence of the concentration of salivary enzymes on sugar breakdown has been studied by comparing acid production of the supernatant and sedimentary fractions of centrifuged, pooled saliva from caries-active patients. Five cubic centimeters of 10 per cent glucose or sucrose has been added to the same volume of sediment or supernatant saliva, and the pH of the mixture has been determined at 5, 15, 30, 45 and 60 minutes of incubation. Acid production was demonstrable in the sediment within five minutes and in 60 minutes required 6 cc. of 0.025 normal sodium

Table 8• Effect of carbohydrate concentration on acid production in glucose-saliva mixtures*

Initial conc. mg. % of glucose	pH of mixtures at various time intervals							Terminal titratable acidity cc./0.025 N acid
	0 min.	30 min.	60 min.	90 min.	120 min.	150 min.	180 min.	
0	6.8	6.2	6.2	6.2	6.2	6.2	6.2	2.0
100	6.8	5.8	5.3	5.1	5.1	5.1	5.0	3.1
500	6.8	5.7	5.1	4.7	4.6	4.4	4.4	5.9
1,000	6.8	5.8	5.0	4.6	4.5	4.5	4.4	5.7
10,000	6.8	5.9	5.1	4.7	4.5	4.5	4.3	5.9

*Mixtures contained 5 cc. of pooled saliva and 5 cc. aqueous solution of glucose.

Table 9 • Acid production in glucose-saliva mixtures

Description of mixture	pH of mixture at various time intervals						Terminal titratable acidity cc./0.025 N acid
	0 min.	5 min.	15 min.	30 min.	45 min.	60 min.	
5 cc. supernatant saliva plus 5 cc. 10% glucose	7.1	7.0	7.0	6.9	6.9	6.8	2.0
5 cc. sediment saliva plus 5 cc. 10% glucose	7.2	6.5	5.5	4.3	4.0	4.0	6.0

hydroxide for neutralization. In contrast, no appreciable acid production was demonstrable in the supernatant sample. These data are recorded in Table 9.

Taken collectively, the data shown in Tables 8 and 9 fortify the belief that the concentrations of sugars and oral enzymes that are likely to be found on the tooth surfaces will support appreciable acid production. Whether or not this acid production is a direct etiologic factor in dental caries is beyond the scope of this paper but is the subject of continuing investigation in the laboratories of our institution.

COMMENT

In closing the author would like to make a strong plea for a more critical understanding of the suspected relation of oral sugar physiology and biochemistry to the etiology of dental caries. It is his personal opinion that generalizations are incompatible with the accumulated findings of responsible investigators. He would remind the many self-appointed armchair experts currently making pronouncements on the subject that professional opinion cannot establish scientific facts.

Method of Science • There are in science immense numbers of different methods, appropriate to different classes of problems; but over and above them all, there is something not easily definable, which may be called the method of science. It was formerly customary to identify this with the inductive method, and to associate it with the name of Bacon. But the true inductive method was not discovered by Bacon, and the true method of science is something which includes deduction as much as induction, logic and mathematics as much as botany and geology. *Bertrand Russell, Mysticism and Logic, 1918.*

Effect of sugar content of foodstuffs on their caries-producing potentialities

Basil G. Bibby, Ph.D., D.M.D., Rochester, N. Y.

The association between sugar and dental caries has become so well established in the mind of the dentist that many have assumed that there must be a direct, proportionate and inviolable relationship between the amount of sugar consumed and the amount of dental caries which will appear. This is, of course, a gross oversimplification. Apart from variations in tooth resistance, which cannot be considered here, variations in the form, composition or manner in which the sugar is used play a part in determining its effectiveness in causing dental decay.

Another oversimplification is to think of the sugar implicated in caries causation only as pure or refined cane sugar (sucrose). Although it is true that sucrose is the principal sugar consumed in common foods, beverages and confections, it is not the only sugar which comes in contact with the teeth. Glucose is being used in increasing amounts in commercially prepared foods and confections. This and other sugars may be formed during food processing or found as natural constituents of vegetables, fruits or milk. Thus, any consideration of the role of food sugars must take into account the total sugar content of the foods, whether it is of natural origin, formed during processing or added before use.

It must also be noted that sugar is seldom used in a pure state, but is almost always combined with other food materials. For instance, even in what are probably its purest uses, as in hard candies or as a sweetening agent in beverages, sugar is combined with flavoring agents or other additives. These additions are probably enough to modify the fermentation or retention of the sugar in the mouth; thus it is unrealistic to assume that laboratory tests made with pure sugar solutions will show what will happen to like concentrations of sugars contained in even simple foods. This would be even more true of the complex mixtures contained in most foods. It seems unlikely, therefore, that the sugar content of foods or the total amount of the sugar consumed in food mixtures would reflect itself in a simple and direct way in the caries picture.

There seems to be no way to determine the relative caries-producing capacities of foods other than to investigate the properties of each food individually. Only when this has been done will it be possible to evaluate the importance of the sugar in each, and only then will the dentist or dietitian be able to recommend some foods rather than others for

Presented as part of a panel discussion "Effects of sugars and other carbohydrates on the teeth" before the Sections on Research, Pedodontics and Public Health Dentistry, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

Director, Eastman Dental Dispensary.

inclusion in caries-preventive diets. Unfortunately, there is no accepted method for estimating the caries-producing potentials of foods, and the authenticity of the facts so far reported has not been established beyond reasonable doubt. In the present evaluation of the caries-producing capacities of foods which contain sugar, it will be seen if differences in the nature of such foods can be established on the basis of the following: (1) theoretical considerations, (2) *in vitro* laboratory tests, (3) animal experiments, or (4) studies in human subjects.

DIFFERENCES IN FOODS

Theoretical Considerations • That fermentation of sugar-containing foods on the tooth surfaces is a fundamental part of the caries attack needs no proof. Any lingering doubts of this should have been removed by the inability to produce decay in animals fed carbohydrates through a stomach tube[1,2] or in animals in which salivary fermentation was prevented either by the exclusion of bacteria[3,4] or by the use of enzyme inhibitors.[5] It is logical, therefore, that any characteristics of foods which will modify in amount or duration their contact with the teeth or which will speed up or retard their fermentation may be regarded as influencing their caries-producing potentialities.

The amount of any sugar-containing food which will be retained on the teeth will be determined principally by its adhesive properties. The basic composition of the food may be the important factor in modifying these. For instance, the glutinous or gummy properties of wheat flour which are necessary for the making of bread, pastry and cakes give products made with it a greater adhesiveness than those made with corn or rice flour. The content of oil, fat or surface active agents could have a noticeable effect. Food processing may change adhesiveness as is the case with some breakfast cereals manufactured by means of high heat. The physical nature of the food will also be important. Granular foods or those with coarse particles would theoretically be bound to the teeth less than those with smooth texture or fine particles. Likewise, solid foods could be expected to stay on the teeth longer than those in liquid form.

The effects of contained sugars will be influenced by their concentration and the ease with which they can go into solution, thus permitting diffusion into tooth spaces or defects or bacterial plaques. Fermentation could be slowed by the presence of fats, enzyme inhibitors or high acidities in the food. Even without invoking the undoubtedly important effects on food clearance of the varying salivary secretion or the varying masticatory function elicited by different foods, it must be obvious that on theoretical grounds alone there are factors other than the sugar content of foods which must play a part in determining their caries-producing potential.

Laboratory Comparisons of Caries-Producing Potentials of Foods • A variety of laboratory methods have been used to indicate the caries-producing effects of various foods. These include the comparison of the following: (1) the acid produced from the foods on incubation in saliva; (2) the amounts of acid formed in saliva collected and incubated after eating; (3) the concentration and persistence of reducing sugars in the saliva;

1. Kite, O. W.; Shaw, J. H., and Sognnaes, R. F. Prevention of experimental tooth decay by tube-feeding. J. Nutrition 42:89 Sept. 1950.

2. Haldi, J., and others. Relative cariogenicity of sucrose when ingested in solid form and in solution by the albino rat. J. Nutrition 49:295 Feb. 1953.

3. Orland, F. J., and others. Use of the germfree animal technic in the study of experimental dental caries. I. Basic observations on rats reared free of all microorganisms. J. D. Res. 33:147 April 1954.

4. McClure, F. J., and Hewitt, W. L. Relation of penicillin to induced rat dental caries and oral L. acidophilus. J. D. Res. 25:441 Dec. 1946.

5. Miller, B. F. Inhibition of experimental dental caries in the rat by fluoride and iodoacetic acid. Proc. Soc. Exper. Biol. & Med. 39:389 Nov. 1938.

(4) the quantity of food adhering to the teeth after eating, which has also been compounded with salivary acid formation values, or (5) the amount and duration of acid formation in dental plaque material.

Acid Production from Foods • A good many investigations have been directed toward showing the relative acid-producing capacity of various pure sugars and starches (monosaccharides, disaccharides and polysaccharides). Although these studies indirectly cast some light on the caries-producing capacities of foods, they differ so much from what is likely to occur when these carbohydrates are mixed with other constituents in the food preparations in which they actually will be consumed that the observations have little relevance to the problem of caries causation. This review, therefore, will consider only tests which have been carried out on unrefined carbohydrate materials or on foods, confections or beverages into which sugar has been mixed.

One of the earliest comparisons of acid production from foods was made by Miller[6] as part of his pioneering investigations in which he established carbohydrate foods as the source of tooth decalcifying acids. Miller measured acid production from different foods as a means of indicating their relative importance in causing caries. For this purpose he incubated bread, potatoes, sugar and other foods in saliva and titrated the acid formed. He found more acid production from bread, cereals and potatoes than from sugar and concluded that they were more important than sugar in causing decay. The adhesiveness of bread was considered to make it particularly destructive.

Walkhoff[7] carried out experiments of the same sort and obtained results which were essentially the same as Miller's but also noted that whole-meal breads produced less acid than white bread. Similar observations were reported by Mose,[8] who tested about 20 foodstuffs and claimed that potato was a much more potent acid producer than bread or the sugars sucrose, maltose or lactose. Honey produced acid slightly more actively than the sugars tested. Actually, the observations of these three investigators do not have much significance because they all used long fermentation periods and, therefore, the final amount of acid formed from the foods was determined by their buffering capacities. Such total acid formation is now believed to be of no importance compared with the speed at which a concentration sufficient to decalcify enamel is produced.

A more direct approach to determining tooth decalcifying properties on various foods was used by Osborn, Noriskin and Staz.[9] They chewed foods and expectorated the resultant saliva-food mixtures into vessels containing teeth which were incubated for several weeks and then examined for the degree of decalcification. The investigators found that refined wheat and mealy flour gave more decalcification than coarse, unrefined mealy foods, sugar solutions or crude sugar juice. Cultures of mouth bacteria were found by Belding and Belding[10] to produce more acid from wheat than sugar media.

That determination of acid formed on fermentation of saliva is not a satisfactory way of differentiating among the caries potentials of foodstuffs, particularly in the sorts of experiments just cited, is indicated by general failure of clinical observations to provide support for the laboratory results. Presumably other factors such as the retention of

6. Miller, W. D. Die mikroorganismen der mundhohle, ed 2. Leipzig, George Thieme, 1892, p. 199.

7. Walkhoff, Otto. Unser Brot als wichtigste Ursache der Zahnkaries. München. med. Wchnschr. 64:1007, 1917.

8. Mose, J. Versuche zur Aetiologie und Prophylaxie der Zahnkaries. Ztschr. f. Stomatol. 46:1 Jan. 1949.

9. Osborn, T. W. S.; Noriskin, J. N., and Staz, J. Inhibition in vitro of decalcification in teeth. J. D. Res. 16:545 Dec. 1937.

10. Belding, L. J., and Belding, P. H. Diet, bacteria and disease. D. Items Interest 62:303 April 1940.

these foods in the mouth or their ability to diffuse into interproximal spaces or fissures may be more important than the amount of acid produced from them by salivary bacteria.

Acid Formation in Saliva After Eating • Acid formation in saliva after eating has been used as a means of indicating which carbohydrate foods would be more likely to cause decay. More than 50 years ago, Read[11] found that more acid was formed after chewing bread made with roller-ground flour than bread made with stone-ground flour. Haggard and Greenberg[12] measured the acidity of saliva after using several liquid and solid foods containing carbohydrates. They found little difference among them, although there was some evidence that the acidity persisted for a longer time after the use of some candies and crackers than after drinking fruit juices and sweetened carbonated beverages.

Goldberg and Bibby[13] have carried out a somewhat similar study in which the saliva was collected at various intervals after eating test foods incubated and tested for acid formation. No great differences among the foods were observed, although it was fairly obvious that acid formation from the foods persisted for a longer period in some mouths than in others. Ericsson and Hellstrom[14] made lactic acid determinations in saliva after the eating of several foods, such as sugar, bread and potatoes, and showed that the acid formation paralleled the presence of sugar in the mouth. Interestingly enough, they found the greatest acid formation after the use of bread. Ludwig and Bibby[15] have also measured lactic acid in saliva and found the greatest amounts persisting for longest periods after the eating of figs and the least after carbonated, sugar-containing beverages.

Concentration and Persistence of Sugar in Saliva • Perhaps the most used method of trying to differentiate between the caries-producing potentials of foodstuffs has been to compare the time of clearance of sugar from the mouth after the use of different sugar-containing materials. Teuscher and Fosdick[16] showed that the sugar concentration in the saliva was elevated for a longer period after the use of candy than after chewing gum or after the eating of a regular noon or evening meal. It was noticed that sugar persisted for a longer time in the mouths of caries-susceptible subjects.

The clearance of sugar taken in various forms was compared by Volker and Pinkerton,[17] who showed that sugar used in solid form persisted in the mouth for a much longer period than sugar which was incorporated in chewing gum or which was taken in liquid form. Caramel, ice cream, crackers and soft drinks were compared by Haggard and Greenberg.[18] They found the highest and longest lasting concentration of reducing sugar after eating caramels; the next highest was given by a mixed meal, then ice cream, crackers, chewing gum, soft drinks, orange juice and grapefruit juice in that order. Similar observations were made by Boyd and Speer.[19]

The most comprehensive study of sugar clearance from the mouth or persistence of sugar in the saliva is that of Lundqvist,[20] who compared 66 foods and

11. Read, T. G. Some chemical changes occurring in the mouth during the mastication of bread composed of roller flour. J. Brit. D. A. 22:590, 1901.

12. Haggard, H. W., and Greenberg, L. A. Acidity of saliva after ingestion of carbohydrate and acid-containing substances. J. D. Res. 30:126 Feb. 1951.

13. Goldberg, H., and Bibby, B. G. Unpublished work.

14. Ericsson, Y., and Hellstrom, I. Salivens mjölksyrehalt efter kolhydrattillförsel. Svensk Tandl. Sälsk. festskr. Stockholm, 1950, p. 115.

15. Ludwig, T., and Bibby, B. G. Unpublished work.

16. Teuscher, G. W., and Fosdick, L. S. Retention of reducing sugars in saliva after the mastication of carbohydrates. Northwestern Univ. Bul. 37:17 Feb. 4, 1937.

17. Volker, J. F., and Pinkerton, D. M. Some observations on the clearance of glucose from the oral cavity. J. D. Res. 26:9 Feb. 1947.

18. Haggard, H. W., and Greenberg, L. A. Concentration of sugar in the saliva after ingestion of carbohydrate substances. D. Survey 25:1788 Dec. 1949.

19. Boyd, L. J., and Speer, F. D. Concentration of sugar in saliva after ingestion of carbohydrate-containing substances. Bul. New York M. Coll. 13:104, 1950.

20. Lundqvist, Claes. Oral sugar clearance. Its influence on dental caries activity. Odont. Revy 3:suppl. 1, 1952.

beverages and used his observations to calculate a "caries potentiality index" for the various foods. The lowest values were given by low carbohydrate foods such as beer, fish and meat. The lowest value for what are recognized as sugar-containing foods was given by lemonade, then by fruit juice and certain fruits such as oranges and strawberries. The highest values were given by toffee, but certain breads and pastries and cookies gave values higher than some other candies. Some of the more interesting values are given in Table 1.

Quantity of Food Adhering to Teeth • Realizing the desirability of differentiating between foodstuffs of the carbohydrate type, Bibby, Goldberg and Chen[21] postulated that the caries-producing potential or what they called "decalcification potential" of a food might be indicated by determining the amount of the food which adhered to the teeth after eating and then by multiplying the value obtained, by the amount of the acid formed when the food was incubated in saliva. This method was used to compare the "decalcification potentials" of a hundred carbohydrate-containing foods. Some typical results are presented in Table 2. In general, it may be noted that this procedure placed foods into relatively the same positions as did Lundqvist's.

Observations of particular interest were that the "decalcification potential" was not directly related to the sugar content of the food and that the presence of fat in the food was associated with lower values. Because "laboratory cakes" with variable proportions of known constituents had been prepared, the effect of fat in reducing food retention was able to be demonstrated. It was also possible to show that the presence of salt and a light consistency of food also reduced

21. Bibby, B. G.; Goldberg, H. J. V., and Chen, E. Evaluation of caries-producing potentialities of various foodstuffs. J.A.D.A. 42:491 May 1951.

Table 1 • Caries potentiality indexes (Lundqvist's) of representative foods

Food	Total sugar %	Sugar concentration in saliva		Caries potentiality index
		Maximum %	Av. clearance time (min.) above 0.2%	
Caramel	64.0	18.8	5	27
Honey + bread + butter	19.0	4.6	7.5	24
Chocolate, light	47.5	10.1	6.25	21
Honey	72.8	5.6	5	18
Sweet cookies (biscuits)	9.0	1.9	5	18
Danish pastry	30.0	2.4	2.5	13
Wheaten bread	12.3	2.8	4	13
Ice cream	2.4	3.2	2.5	9
Marmalade	65.3	3.5	3.5	10
Marmalade + bread + butter	16.3	1.8	2.5	9
Potatoes (boiled)	0.8	1.6	2	7
Potatoes (fried)	3.9	0.4	2.5	7
White bread + butter	1.5	0.8	2	7
Coarse rye bread + butter	2.3	1.3	2	7
Milk	3.8	0.6	2	6
Apple	7.5	0.4	1	5
Orange	6.5	0.3	1	3
Fruit juice	11.5	1.2	1	3
Lemonade	9.3	0.5	0.75	2
Carrot (boiled)	2.4	0.1	..	1

Table 2 • Food retention and decalcification potentials of representative foods*

Food	Total carbohydrate %	Free sugar† %	Food retained mg.	4-hour acid formation ml. 0.1 normal sodium hydroxide	Decalcification potential
Cookie (fig)	70	27.6	678	1.2	814
Date	77.5	33.8	507	1.6	811
Chocolate	50	39	370	2.1	777
Ice cream	17	..	423	1.6	677
Cookie (shortbread)	59.5	24.8	370	1.3	481
Danish pastry‡	53.8	40	181	1.6	434
Cracker (salted)	70	11.0	340	1.2	408
Caramel‡	56.8	43	219	1.8	394
Chocolate pudding‡	35	18.5	300	1.3	390
Cracker (oil sprayed)	71	12.1	310	1.2	372
Toffee	90	..	266	1.3	346
White bread	49	13.0	188	1.8	338
Potato (boiled)‡	18.2	4.0	128	2.4	307
Cola drink	10.5	10.5	237	1	237
Apple	17.5	11.0	228	1	228
Orange soda	10.5	10.5	219	1	219
Orange juice (fresh)	8.5	..	177	1.2	212
Potato chips‡	48.2	12.7	61	1.9	116
Carrot (fresh)	9.5	..	73	1.2	88
Carrot (cooked)‡	8.3	6.8	2	1.5	3

*Ludwig, T. Master of Science thesis. University of Rochester, 1954.

†Sugar recovered in water filtrate.

‡Values from Bibby, B. G.; Goldberg, H. J. V., and Chen, E. Evaluation of caries-producing potentialities of various foodstuffs. J.A.D.A. 42:491 May 1951.

the retention of the food and thus reduced the decalcification potential.

Although the investigators feel that some information which will be of use in distinguishing between the caries-producing potentials of foods came out of the study, they do not feel that the values which they obtained should be taken as anything like a true quantitative index of the caries-producing potentials. These reservations are made because they feel that their test procedure, which depended rather too heavily on the suitability of the test subjects, was inclined to give irregular results. Further, because, by the method used, only narrow differences were found among the amounts of acid formed from the different foods, the broad variations which appeared in retention unduly influenced the decalcification potential values. This influence was further exaggerated by the fact which was subsequently discovered[22] that the retention values were not determined entirely by the food retained on the teeth but that with different foods different proportions were held on the mucous membranes and the teeth. For instance, the retention of dates was about the same in the two regions, apples were retained almost entirely on the teeth, but only about 20 per cent of the retention of liquids was on the teeth and 80 per cent on the mucous membranes.

Amount and Duration of Acid Formation in Plaque • In an attempt to make a further refinement of measurements which might indicate a caries-producing effect of different foods, the amount and duration of acid formation in the so-called plaques on tooth surfaces was investigated.[22] It appeared that there should be a closer relation between the acid production in the bacterial accumulations on the teeth and dental caries than would be likely to be established by any measurements in the saliva. Acid

22. Ludwig, T. Master of Science thesis, University of Rochester, 1954.

formation in plaques was determined by eating or drinking test foodstuffs and taking samples of plaque material at intervals thereafter and determining the concentration of acid formed by making pH measurements with a single drop glass electrode.

The pH in plaque material after the consumption of some representative foods and beverages is given in Figure 1. The reliability of these observations was supported by lactic acid measurements in the saliva which gave parallel results with the same foods. Low acid formation was found with nonadhesive sugar sources such as apple and fried potatoes. It is interesting to note that sugars in liquid form, such as in orange juice or carbonated beverages, gave equally low values, and that the formation of acid lasted a shorter time after the liquids than after the other foods.

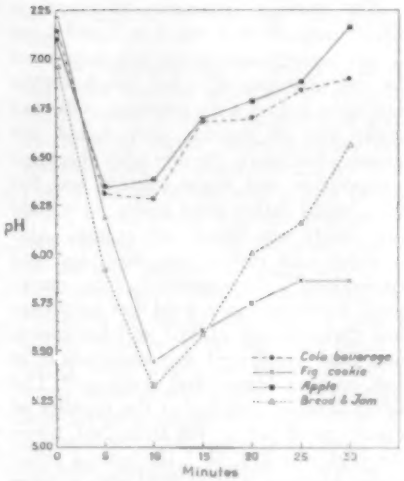


Fig. 1 • Acidity of plaques after consumption of representative foodstuffs. All values mean of five subjects

Animal Experiments • It is wise to begin any consideration of animal studies by stating that evidence from this source has in the past led to erroneous conclusions and should be accepted with some caution. The observations[23] of Bibby, Goldberg and Chen of extremely high caries in hamsters fed on carrots which all other tests show to have a low caries-producing potential gives a special reason for maintaining reservations in this field of study. Nevertheless, animal experimentation has considerable value, not only as a means of providing a measure of confirmation for theories supported only by *in vitro* evidence, but also as a means of supplying information on which new hypotheses can be built. Although very few animal experiments have been concerned with the types of diets or food substances actually used by human subjects, support can be found in some studies for ideas developed earlier in this paper.

Evidence that carbohydrate sources other than sugar and the manner of processing foods could influence caries was found in cotton rats by Constant, Phillips and Elvehjem,[24] who concluded that "under certain conditions complex carbohydrates may be as cariogenic as simple sugars." In their study, a processed cereal diet of corn flakes and 30 per cent sugar produced more caries than 60 per cent of sugar in an unprocessed corn diet. That the average human Western diet contributes to the caries-producing capacity of sugar can be implied from the results of studies by Zepplin and co-workers[25] which showed that 17 per cent of sucrose in a diet compounded to match the average human diet caused as much caries as 67 per cent of sucrose in their laboratory diet.

23. Bibby, B. G.; Goldberg, H. J. V., and Chen, E. Caries production in hamsters by different foods. (Abst.) J. D. Res. 30:485 Aug. 1951.

24. Constant, M. A.; Phillips, P. H., and Elvehjem, C. A. Dental caries in the cotton rat. XIII. Effect of whole grain and processed cereals on dental caries production. J. Nutrition 46:271 March 1952.

25. Zepplin, M., and others. Dental caries in the cotton rat. XI. Effect of feeding natural diet comparable to human diet. J. Nutrition 40:203 Feb. 1950.

The various laboratory observations which indicate that sugar in liquid form is not actively cariogenic are supported by the observation[26] that when cotton rats were fed on a dry oatmeal, milk and sugar diet 26 cavities were found per animal, but when the diet with the same composition and sugar content was fed in a liquid rather than a dry form only one cavity was found per animal. Also working with cotton rats, Anderson and co-workers[27] demonstrated that cariogenic substances in a fluid diet gave very low caries scores. Haldi[2] and his associates have confirmed this observation in rats, as have Harris and Stephan.[28] The latter workers found that the number of carious teeth per rat fell from 2.87, when the diet was dry, to 1.16, with a small water addition, and to 0.37 with a large addition.

The laboratory indication that there was no greater caries production from refined sugar than natural sugars is supported by Smith,[29] who showed that natural syrup in a purified diet produced as much caries activity as sucrose when fed in a similar way. Constant, Phillips and Elvehjem[26] obtained similar results. That fat can reduce the caries-producing capacity of sucrose was supported by Schweigert and co-workers'[30] investigation which showed that in cotton rats, additions of fat to the diet reduced the incidence of caries even though the sucrose level was the same.

The significance of the "decalcification potential" which Bibby, Goldberg and Chen offered as a means of distinguishing between the caries-producing potentials of foods received only partial support in hamster studies.[31] Some definite correlations were shown, but some striking exceptions also appeared.

The possibility that the concentration of sugar in the diet is an all-important determinant in caries production is contradicted by the several animal experiments which showed similar caries production in animals fed diets with widely different sugar concentrations. Further, the ability to change caries activity in animals consuming equal quantities of sugar by the addition of fat or water certainly indicates that other variables must be as important as the sugar concentration.

Effects of Sugar in Foods in Human Subjects • In the last analysis, clinical studies on human subjects will alone establish the relation between the sugar content and the caries-producing capacity of foodstuffs. Unfortunately, man does not lend himself well for experimental purposes. He uses a diet so complex, so varied and under such poor control that it is impossible to determine whether the inclusion of a single foodstuff has had an important effect in changing the caries picture. The situation is further complicated by the fact that foodstuffs themselves vary from place to place or according to the individual recipe of the cook or manufacturer. Thus, although there are theoretical reasons for assuming that a change, such as one in the sugar concentration of bread, might influence bread's caries-producing capacity, it is impossible to find convincing evidence in natural or controlled diets of human subjects to support this theory.

Some inferences can be drawn from the study of the naturally occurring use of certain foodstuffs and the caries activity in different population groups. For

26. Constant, M. A.; Phillips, P. H., and Elvehjem, C. A. Dental caries in the cotton rat. XII. Natural versus refined sugars. J. Nutrition 43:551 April 1951.

27. Anderson, E. P., and others. Dental caries in the cotton rat. X. Effect of fluidity of the ration. J. Nutrition 35:371 March 1948.

28. Harris, M. R., and Stephan, R. N. Effect of mixing water in the diet on the development of carious lesions in rats. (Abst.) J. D. Res. 32:653 Oct. 1953.

29. Smith, J. K. Physical state of ration influencing dental caries in cotton rat. Master of Science thesis, University of Wisconsin, 1948.

30. Schweigert, B. S., and others. Dental caries in the cotton rat. VIII. Further studies on the dietary effects of carbohydrates, protein and fat on the incidence and extent of carious lesions. J. Nutrition 32:405 Oct. 1946.

31. Bibby, B. G., and Goldberg, H. J. Y. Unpublished work.

instance, a suggestion that sugar and flour mixtures are conducive to caries is found in the increased caries rate associated with higher consumption of baked goods. Table 3, which is compiled from Dunning's report,[32] and Nizel and Bibby's[33] and Finn's[34] caries surveys, shows that more baked goods are eaten in regions or by groups known to have higher caries rates.

Similarly, support for the idea that consumption of sugar in liquid form is not conducive to caries can be implied from the absence of a direct relationship (Fig. 2) between high caries rates in the north and eastern states where there is a relatively low consumption of sugar-containing carbonated beverages and the low caries rates in the southern states where consumption is much higher. It should be noted, however, that the high fluoride content of the drinking water in states such as Arizona (number 2 in Fig. 2), New Mexico (number 30), and Texas (number 42) may be the reason for the low caries rate associated with high carbonated beverage consumption. That the cariogenic effects of cakes and pastries overshadows that of sweet carbonated beverages is suggested by the high caries incidence found in some areas such as Maine (18), Massachusetts (20), New Hampshire (28), New Jersey (29), and New York (31) which have high consumption of baked goods and low use of beverages.

It can be noted that the data on DM rates were based on an adult group of men, whereas the data on consumption of carbonated beverages were based on a cross section of the whole population. No more pertinent caries data were available. If the study had been based on three or four other national surveys of military personnel or augmented with caries incidence studies on other age groups, many disqualifying statistical difficulties would have been encountered. The 1944 caries data obtained were as close in time as any others to the best recent carbonated beverage consumption data.

The Vipeholm study[30] seems to be the only well planned study of the effect on human teeth of the consumption of sugar in different forms. After patients used several types of sugar-containing foods over a period of one and a half to four years, it was found that the incidence of new carious lesions did not always parallel the total amount of sugar consumed. Less caries developed after mealtime consumption of 94 kg. of sugar a year in liquids than when 44 kg. were eaten in bread with meals, or when 52 kg. of sugar, some of which was taken as chocolate between meals, was used (Fig. 3). These observations provide evidence that the total quantity of sugar eaten does not alone determine caries activity, and that sugar taken in liquid form is less cariogenic than when it is mixed with flour, as in bread, or other materials which tend to bind it to the tooth surface or otherwise influence the biochemical processes taking place there. That the sugar in chocolate was less conducive to caries than sugar taken in other media, such as toffee, fits in with some observations such as laboratory evidence of slow clearing of sugar after eating caramels and toffee and the possible caries-preventing effect of fat.

The effects of adding refined (white) sugar, unrefined (brown) sugar and unrefined sugar syrup (treacle) to an adequate diet in British orphanages were compared.[35] No additional carious lesions resulted, and a slightly lower caries

32. Dunning, J. M. Influence of latitude and distance from seacoast on dental disease J. D. Res. 32:811 Dec. 1953.

33. Nizel, A. E., and Bibby, B. G. Geographic variations in caries prevalence in soldiers. J.A.D.A. 31:1619 Dec. 1, 1944.

34. Finn, S. B. Prevalence of dental caries. In the National Academy of Sciences—National Research Council's Survey of the literature of dental caries. Publication 225. Washington, D.C., Academy, 1952.

35. King, J. D., and others. Effect of sugar supplements on dental caries in children. Medical Research Council, special report series no. 288. London, Her Majesty's Stationery Office, 1955.

Table 3 • Caries activity and weekly family consumption of breads, cakes and pastries

Region	Caries activity*	Weekly consumption in pounds†		
		Farms	Villages	Small cities
New England, Middle Atlantic and North Central	High	7.2	8.4	7.8
Plains, Mountain and Pacific	Moderately high	4.3	6.7	7.3
Southeast: White farm operators	Low	1.4	4.1	4.9
Negroes	Very low	.4	1.2	1.6

*Based on Nizel, A. E., and Bibby, B. G. Geographic variations in caries prevalence in soldiers. J.A.D.A. 31:1619 Dec. 1, 1944; and Finn, S. B. Prevalence of dental caries. In National Academy of Sciences—National Research Council's Survey of the literature on dental caries. Publication 225. Washington, D. C., Academy, 1952.

†Not including homemade baked goods. From Dunning, J. M. Influence of latitude and distance from seacoast on dental disease. J. D. Res. 32:811 Dec. 1953.

increment in the unrefined sugar group is almost certainly the result of there being fewer caries-susceptible surfaces in the children of that group at the start of the experiment. Since the additional sugar was consumed only with the meals, it is not surprising that it had no effect on caries activity.

EATING: FREQUENCY AND DURATION

The studies cited earlier show that the sugar-containing foods are rapidly removed from the mouth. (Figure 4 shows typical clearance curves.) Thus, it can be reasoned that since conditions necessary for caries attack persist for only 15 minutes or so after each eating of a cariogenic food, an important factor in increasing the strength of the caries attack will be either the duration of the eating process or the frequency of eating. If the eating process should take about an hour, as in the case of an all day sucker, a harmful sugar concentration would be maintained in the mouth for at least the same period. If the sugar was consumed rapidly in liquid form, however, such an effect would persist for only a few minutes.[17] If published data[18, 19] which show that sugar persists in the mouth for about 15 minutes after a meal are used, it can be reasoned that a person eating only three meals a day would, in addition to the eating period, provide conditions conducive to caries attack for about 15 minutes after each meal. This would represent about three quarters of an hour active caries attack during the day. On the other hand, if the subject ate six meals a day the period of caries attack would be twice as long.

It is not, however, the multiplication of set meals which is the important factor in prolonging the caries attack, but the taking of sugar-containing foods between meals. It is in this way that the total period of caries attack is magnified. Thus, it can be argued that if a person should eat a pound of candy at one sitting of 15 minutes, and it takes 15 minutes thereafter for sugar clearance, that pound of candy will produce a caries attack lasting for half an hour. If on the other hand, the pound of candy is eaten in 40 separate mouthfuls, each representing a piece of candy, then instead of a total period of caries attack of half an hour, there would be 40 periods of caries attack of 15 minutes each or 10 hours of caries attack. This leads to the important conclusion that the frequency of eating is of more importance in the causation of caries than the total amount of carbohydrate or sugar eaten.

There is a fair amount of human clinical evidence to support such a conclusion. Some 20 years ago, before the reasons offered previously were known, an analysis of the dietary habits and caries

activity values of a number of population groups[36] led to the conclusion that there was a closer correlation between the frequency of eating and caries susceptibility than the adequacy or inadequacy of any dietary constituent. Several clinical studies[37-41] have noted low caries activity in groups of children who did not eat between meals and high caries activity associated with frequent eating.

Other, more general observations suggesting the relation between the frequency of eating and caries activity can be cited. Almost all institutionalized children have lower caries activity than those

36. Bibby, B. G. Neglected factors in the study of dental caries. J.A.D.A. 22:222 Feb. 1935.

37. Koehne, M., and Bunting, R. W. Studies in the control of dental caries. J. Nutrition 7:657 June 1934.

38. Drain, C. L., and Boyd, J. D. Control and arrest of dental caries: an institutional study. J.A.D.A. 22: 155 Jan. 1935.

39. Staz, J. Dental caries in Johannesburg Indian children. S. African D. J. 17:152 May 1943.

40. Read, T. T., and Knowles, E. M. Study of the diet and habits of school children in relation to freedom or susceptibility to dental caries. Brit. D. J. 64:185 Feb. 15, 1938.

41. Wilkins, E. H. Dental caries in New Zealand and Birmingham school children. Brit. J. D. Science 71:27 Oct. 1927.

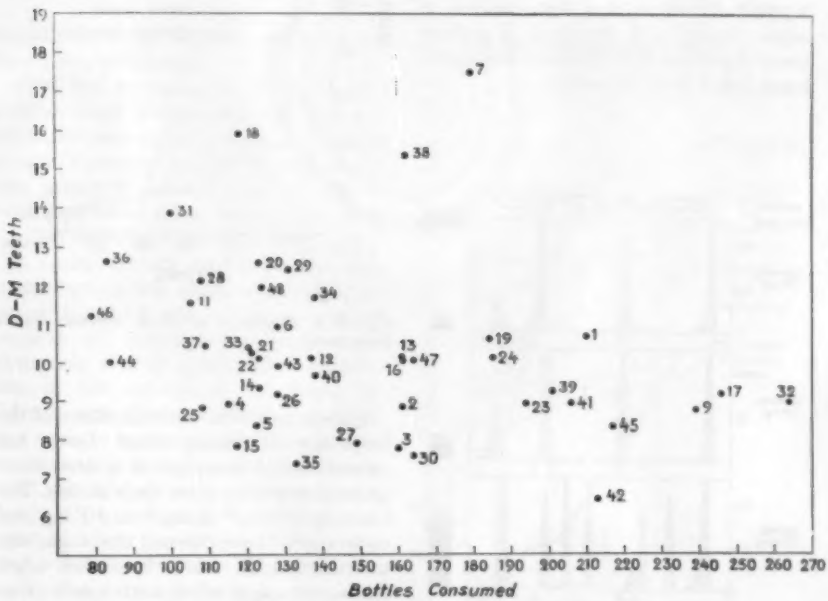


Fig. 2 • Relation between consumption of carbonated beverages and dental caries. Data for DM teeth from Nizel, A. E., and Bibby, B. G. Geographic variations in caries prevalence in soldiers. J.A.D.A. 31:1619 Dec. 1, 1944; data for beverage consumption based on 1947 information from U.S. Department of Commerce, Bureau of the Census

Points represent DM teeth and per capita consumption of carbonated beverages for states as follows:

1, Ala.	*7, Del.*	*15, Kan.*	*21, Mich.*	*27, Nev.*	*33, N.D.*	*39, S.C.*	*45, Va.*
2, Ariz.	*9, Fla.*	*16, Ky.*	*22, Minn.*	*28, N.H.*	*34, Ohio*	*40, S.D.*	*46, Wash.*
3, Ark.	*11, Idaho*	*17, La.*	*23, Miss.*	*29, N.J.*	*35, Okla.*	*41, Tenn.*	*47, W. Va.*
4, Calif.	*12, Ill.*	*18, Maine*	*24, Mo.*	*30, N.Mex.*	*36, Ore.*	*42, Texas*	*48, Wis.*
5, Colo.	*13, Ind.*	*19, Md.*	*25, Mont.*	*31, N.Y.*	*37, Pa.*	*43, Utah*	*49, Wyo.*
6, Conn.	*14, Iowa*	*20, Mass.*	*26, Neb.*	*32, N.C.*	*38, R.I.*	*44, Vt.*	

who are free to visit candy stores or raid cooky boxes. The reduced caries activity observed in wartime groups can, to a large extent, be accounted for by reduced frequency of eating by people whose food is rationed. The low caries activity in population groups where there is a scarcity of food can be explained on the same basis. It is probable that all observant practitioners will have noted that most of the patients who have rampant dental decay are those who are perpetually nibbling on candies or foods of other sorts. Thus, what might be called "natural experiments" in human subjects support the thesis that the duration of sugar contact with the teeth is perhaps more important than the total amount of sugar taken into the mouth.

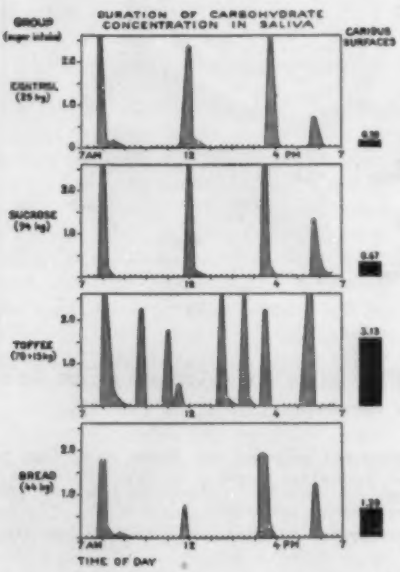


Fig. 3 • Sugar intake, salivary carbohydrate and caries activity in human study groups. (Modified from Lundqvist, Claes. Oral sugar clearance. Its influence on dental caries activity. Odont. Revy 3:suppl. 1, 1952

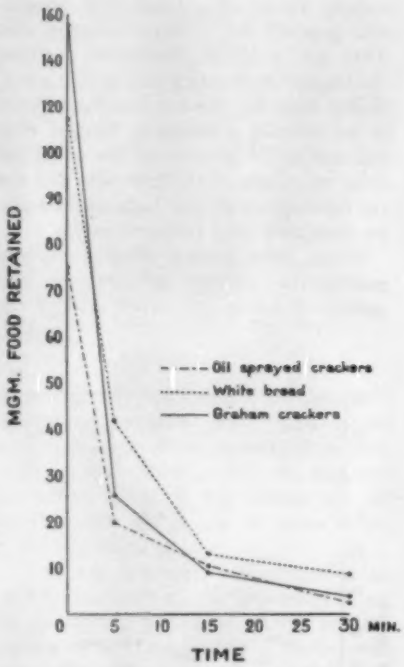


Fig. 4 • Clearance of three common foods from teeth

Failure to realize the importance of the frequency of eating sweet foods has caused several investigators to draw erroneous conclusions from their studies. For example, Mack,[42] King,[43] and King and co-workers[35] have claimed that sugar was unimportant in caries causation when additional sugar taken with meals or at one additional time failed to produce increased dental decay. If due consideration had been given to the factors just

42. Mack, P. B. Two-year study of the results of an improved dietary fed to a group of institutional boys initially superior in nutritional status. Monographs of the Society for Research in Child Development, vol. 13. Washington, D. C., National Research Council, 1949, p. 62.

43. King, J. D. Dental caries. Effect of carbohydrate supplements on susceptibility of infants. Lancet 1:646 May 4, 1946.

Table 4 • Manner of sugar consumption and caries activity*

Manner of using sugar	No. patients	Duration of study	Sugar consumed kg. per year		Clearance time % of day sugar in saliva	New carious surfaces per person per year
			With meals	Between meals		
Control	60	3 yr. 11 mo.	25	..	10.1	0.30
Liquid sucrose with meals	57	3 yr. 11 mo.	94	..	13.5	0.67
Chocolate	47	2 yr.	41	11	23.5	1.17
8 toffees	40	2 yr. 11 mo.	70	15	24.7	3.13
Caramel	62	1 yr. 6 mo.	77	27	34.9	2.47
24 toffees	48	1 yr. 8 mo.	65	43	57.8	4.02
Bread	41	3 yr. 11 mo.	44	..	8.9	1.30

*Table compiled from data by Lundqvist, Claes. Oral sugar clearance. Its influence on dental caries activity. Odont. Revy 3:Suppl. 1, 1952. Lengths of study periods interpreted from charts and sugar values for two study periods prorated to annual basis.

considered, their negative results could have been anticipated.

That the frequency of eating is the greatest single determinant in caries activity receives support in the comprehensive Vipeholm study.[44] In this study, some groups of patients were fed only at meals and others given eight or 24 pieces of toffee or caramel to eat at other times. The caries activity in the toffee and caramel group was much higher than in groups in which the equal or greater amounts of carbohydrate foods were taken only during meals. The observations in this experiment are shown in Table 4 and Figure 5. Certain conclusions seem to be inescapable. One is that the frequency of eating and the consequent duration of food retention in the mouth is an important determinant in caries activity. Another is that vastly more sugar can be taken (at meals) in liquid than in other forms, such as in bread, and still produce less dental decay.

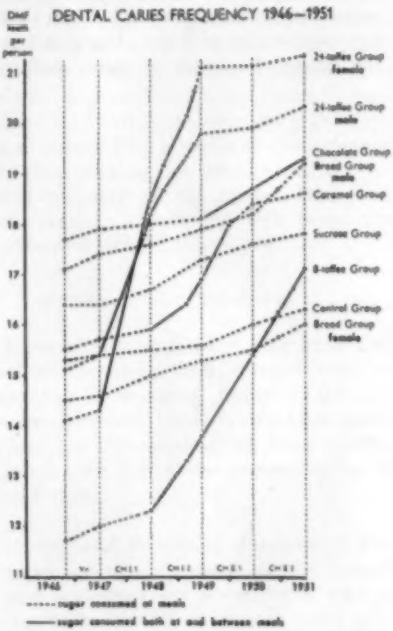


Fig. 5 • Effect of between-meal eating on caries activity. (From Gustafsson, B. E., and others. Effect of different levels of carbohydrate intake on caries activity in 436 individuals observed for five years. In Vipeholm dental caries study. Acta Odont. Scandinavica 11:232 Sept. 1954. Reproduced by permission of the authors)

CONCLUSIONS

At this point it must be fairly obvious that although a considerable amount of work has been focused in one way or another on trying to determine the relative caries-producing capacities of different foods, no final conclusion can be

drawn and no definite or final classification of all foodstuffs, according to their caries-producing capacities, can be offered. The work which has been quoted, however, brings out a number of points which it is felt will stand the test of further experimentation and study.

1. The persistence of sugar in the mouth, the acid formed in the mouth and the other theoretical caries-production indexes of foods are not determined solely by the concentration of sugar in the foods. It is clear that the nature of materials with which the sugar is mixed is a very important factor.

2. The physical nature of the carbohydrate carrier or food has a most important influence on caries production. Findings on the rate of sugar clearance from the mouth, the teeth or saliva and the duration of acid persistence in saliva or plaques all indicate that the effects of sugar last for a shorter time after the sugar is used in liquid as compared with solid or semi-solid form. Therefore, on theoretical grounds, sugar taken in liquid form should initiate less caries than comparable amounts of sugar taken in a solid state or in combination with other adherent substances. This conclusion is supported by both animal experiments and studies on human subjects.

3. The frequency of eating carbohydrate or sugar-containing foods is a most important factor in determining the caries activity of foods.

44. Gustafsson, B. E., and others. Vipeholm dental caries study. Effect of different levels of carbohydrate intake on caries activity in 436 individuals observed for five years. Acta Odont. Scandinavica 11:232 Sept. 1954.

Past and Future • We may be proud, as men, when we contemplate the immense task already accomplished by our ancestors and our contemporaries, but our historical experience makes it easier to realize that, however immense, it is small in comparison with what remains to be done. We have begun the ascent of a formidable mountain, but we are as yet hardly above the plains. We are surrounded by infinities and mysteries everywhere; the possibilities of the cosmos of which we form such an infinitesimal part are hardly explored. It is difficult to know which is more admirable, our knowledge or our ignorance. *George Sarton, Introduction to the History of Science, vol. 1, p. 32.*

Self-curing resins for repairing dentures: some physical properties

John W. Stanford, B.S.; Claire L. Burns,† and George C. Paffenbarger,* D.D.S., Washington, D.C.*

One of the first dental uses of the new self-curing resins, based on methyl methacrylate, was as a repair material for artificial dentures. Few data on their physical properties have been published, however. In this paper the strength of repairs effected and the dimensional changes occurring during repairs of artificial dentures with self-curing repair resins are compared with the strength and dimensional changes of repairs accomplished with the heat-curing resins. Because self-curing repair resins are being used in practice, a tentative specification will be offered later.

The self-curing resins appear to offer the following advantages over the heat-curing type for use in repairing dentures: (1) The repair can be made quickly with the self-curing resins, while the patient waits. In the conventional methods of repairing a denture with the heat-curing resins, the patient may be without the denture for many hours. (2) No heating equipment is needed to process the self-curing resins. On the other hand, controlled heaters are necessary to maintain the temperature and time cycle in processing properly the conventional repair. (3) Since no external heat need be applied to polymerize the self-curing resins, the denture is not warped. When heat-curing resins are used in the customary repair process and the repair is made in boiling water, warpage invariably results. The high-expanding resin is confined in the low-expanding plaster of paris mold and the resin is thereby strained. The strain is partially relieved when the repaired denture is removed from the gypsum model. This is evidenced by a change in dimension as the denture will not reseat properly on the model. Data and observations concerning this point are presented later in this paper.

MATERIALS AND TECHNICS

Materials Investigated • Five brands of self-curing resins and three brands of certified heat-curing resins (Table 1) were examined. Other brands were available, but the resins which were investigated were felt to be representative of each type.

Mixing and Processing Technics • The respective manufacturers of the brands used recommended a variety of processing technics. All specimens were pre-

Presented before the American Denture Society, Miami Beach, Fla., November 5, 1954.

Statistical analysis performed by Mr. John Mandel, testing and specification section, National Bureau of Standards.

*Research associate, National Bureau of Standards Fellowship Division of the Council on Dental Research of the American Dental Association.

†Physical science aid, National Bureau of Standards.

Table 1 • Resins Investigated

Type	Brand	Batch numbers Powder	Batch numbers Liquid	Manufacturer	Date material received
Self-curing	Biofast	None	None	B. L. Dental Co., Richmond Hill, N.Y.	Nov. 1952
	Duz-All	None	None	Coralite Dental Products Co., Chicago	July 1953
	Fastcure	54	62	Acralite Co., Inc., New York City	Oct. 1953
	Nu-Densoform	None	None	Cosmos Dental Products Inc., N.Y.C.	Nov. 1952
	Nuweld	0411P	E281	L. D. Caulk Company, Milford, Del.	July 1953
Heat-curing	Acralite	422	477	Acralite Co., Inc., New York City	June 1953
	Certified	1149E-R	1149AR	Lee Smith Company, Chicago	June 1953
	Denture Acrylic	03551078	03952105	S. S. White Dental Mfg. Co., Phila.	June 1953

pared by compression molding as described by the manufacturer. The heating schedule was 1½ hours at 73°C. (163.4°F.) plus ½ hour at 100°C. (212° F.) for the heat-curing resins. The flasks were then cooled in air for 30 minutes, and immersed in water at 23 ± 10° C. (73 ± 18°F.) for 15 minutes.

PHYSICAL PROPERTIES

Physical properties of the self-curing resins were obtained by the tests described for Type II (self-curing) resins in American Dental Association Specification No. 12 for Denture Base Resin.[1]

Plasticity • The rate of polymerization of the self-curing resins governs the available time for trial packing at room temperature. This working time is controlled by the changes in the plasticity of the resin. The proper plasticity for starting the packing was arbitrarily taken as the time when the doughy material separated cleanly from the sides of the mixing jar. The packing test employed was that described in Specification No. 12.[1] The time elapsed from start of mix until the resin dough separated cleanly from the jar varied from 3.5 to 4.5 minutes for the five brands of self-curing resins investigated. The three certified heat-curing resins reached this plasticity in 18 minutes on the average. In accordance with the specification, the packing test was not started until five minutes after this proper plasticity was reached. All brands investigated were satisfactory.

Porosity • The porosity test as outlined in the specification consists of a visual inspection of the cured resin. Examination of the repair resins showed that Biofast, Duz-All, Fastcure and Nuweld were not porous. Nu-Densoform had small bubbles or voids. None of the heat-curing resins was porous.

Water Sorption and Solubility • All the resins tested met the requirements of the specification for water sorption and solubility (Table 2). There was no significant difference in solubility or water sorption among the brands of each type.

Table 2 • Sorption and solubility of resins

Resin	No. of specimens	Water sorption	Water solubility
		mg./cm.^{3}	mg./cm.^{3}
Self-curing	10	0.4	0.03
Heat-curing	6	0.6	0.01
A.D.A. Spec. No. 12 for denture base resin	—	0.7 max.	0.04 max.

1. Swaney, Aubrey C., and others. American Dental Association specification no. 12 for denture base resin: second revision. J.A.D.A. 46:54 Jan. 1953.

Color Stability • On the basis of the existing specification requirement for color stability, three of the five brands of self-curing resins (Biofast, Nu-Densoform, Duz-All) failed, assuming a brownish or yellowish tinge; one (Fastcure) discolored so slightly that the change in color was barely perceptible; the remaining one (Nuweld) complied easily with the requirement; that is, no change in color was perceptible. Figure 1 shows the specimens two months after the 24 hour exposure to ultraviolet light. All the heat-curing resins were color stable. This test is qualitative and relies on a visual inspection of exposed and unexposed portions of the specimens.

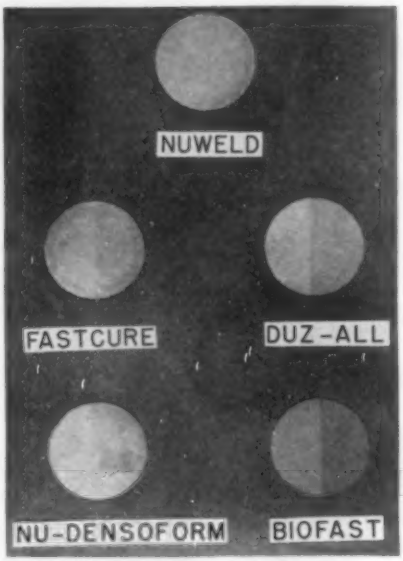


Fig. 1 • Appearance of resin disks after right side has been subjected to color stability test as stated in A.D.A. Specification No. 12[1]

Transverse Tests • Data on the strength and stiffness of resins in transverse bending are given in Table 3. The specification values for deflection from loads of 1,500 Gm. (3.3 pounds) to 3,500 Gm. (7.7 pounds) and 5,000 Gm. (11 pounds) for denture base resins of both self-curing and heat-curing types also are given in the table. Graphs of the deflection of the resins with respect to load applied are shown in Figure 2. These data show that none of the brands of self-curing repair resins complied with the requirements of the specification for a Type II self-curing denture base resin. Failure of all self-curing repair resins occurred at or before the 5,000 Gm. (11 pounds) load; there-

Table 3 • Transverse test results with self-curing repair and heat-curing resins

Brand	Number specimens tested	Deflection for loads 1,500 Gm. to					Load at failure
		2,500 Gm.	3,500 Gm.	4,000 Gm.	4,500 Gm.	5,000 Gm.	
		mm.	mm.	mm.	mm.	mm.	Gm.
Biofast	5	1.3	3.4	*	—	—	4,000
Duz-All	5	1.3	3.1	4.8	—	—	4,100
Fastcure	5	1.2	2.7	4.0	*	—	4,500
Nu-Densoform	5	1.1	2.5	3.8	—	—	4,300
Nuweld	5	1.0	2.2	2.9	4.0	*	5,000
A.D.A. Spec. No. 12 self-curing resins	—	—	2.5 max.	—	—	3.5 min. 6.5 max.	—
Acralite	5	—	1.6	—	—	3.0	6,500
Certified	5	—	1.6	—	—	3.4	6,700
Denture Acrylic	5	—	1.4	—	—	3.0	6,600
A.D.A. Spec. No. 12 heat-curing resins	—	—	1.8 max.	—	—	2.0 min. 5.0 max.	—

*Specimens broke before reading could be taken.

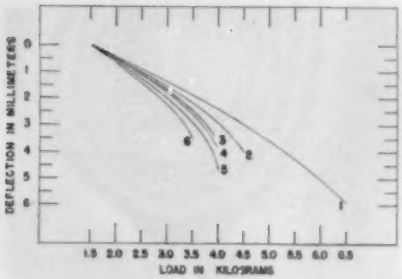


Fig. 2 • Deflection and strength in transverse bending of self-curing repair resins and heat-curing resins. Heat-curing resins: 1. Average of three (Table 1). Self-curing repair resins: 2. Nuweld; 3. Nu-Densoform; 4. Fastcure; 5. Duz-All; 6. Biofast

fore, no deflection readings could be obtained for this load (Table 3).

STRENGTH AND STIFFNESS OF REPAIRS

After comparing the strength and stiffness (in transverse bending) of the self-curing repair resins with heat-curing resins, it was decided to investigate the strength of the bond to the denture base resin developed by the two types. The method chosen was based on the transverse test in the specification. Plates of each of the clear resins of the three heat-curing brands (Table 1) were made in a gypsum mold as shown in Figure 3. A quarter inch section was cut from the center of each plate. The two large pieces were replaced in the mold and the cut-out section was filled with pink repair resin (Fig. 4). This process resulted in a butt joint which is not generally used in repairing dentures; however, it gave the most consistent results among the various types of joints tested.

To determine the effect of the time of packing on the strength of the repair, the self-curing repair resins were packed at three different stages of plasticity. These stages were dependent on the elapsed time from the beginning of the mix to completion of the packing of the repair. The heat-curing resins were packed when they pulled free from the sides of the mixing jar. Five specimens were machined from each repaired plate. A typical specimen is shown at the bottom of Figure 4. After the specimens were tested they were examined to determine the type or condition of break. The two typical breaks obtained are shown in Figure 5. The specimen at the top was repaired with heat-cured resin. The fracture in this instance, as in all the heat-cured repairs, was through the center of the repaired area where the stress was applied. The specimens repaired with the self-curing resin (Fig. 5, bottom) broke at the bond without exception. A strong bond was formed between the repaired area and the original block in the case of the heat-cured repair, whereas a weak bond was formed with the self-cured repair.

The data for repairs made with the

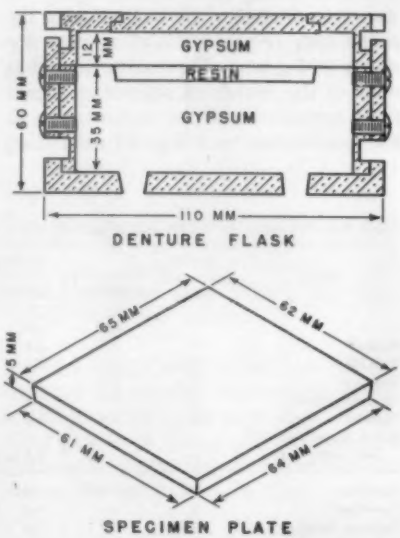


Fig. 3 • Resin plate and its position in flask during processing

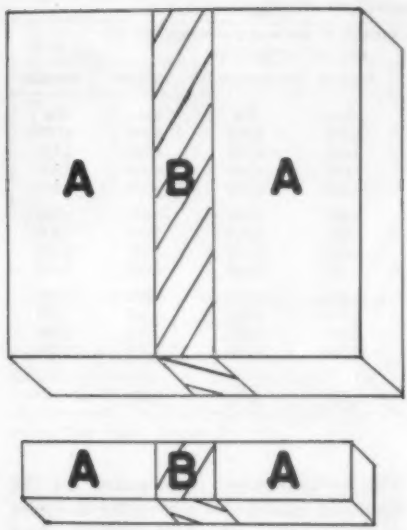


Fig. 4 • Repaired resin plate and example of specimen machined from it. A. Clear. B. Pink (repaired area)

self-curing repair resins are given in Table 4. Table 5 presents a summary of these data as well as a comparison with unrepaired specimens and with specimens repaired with heat-curing resins. The average strength of specimens repaired with the heat-curing resins was approximately 5,400 Gm. This was approximately 80 per cent of the original strength of the clear heat-cured resins (6,600 Gm.). There was no significant difference in strength of the repaired specimens among the brands of heat-curing resins used in repairing the blocks. The average strength of the self-curing repairs packed in stage 1 was 60 per cent of the original strength.

A statistical analysis was made of the data presented in Table 4 and led to the following conclusions:

1. The standard deviation measuring the variability between specimens from the same block is approximately 200 Gm.

2. The self-curing resins involved in this experiment fall into two groups, based on transverse strength. Biofast and Duz-All represent the group of lower strength, while Fastcure, Nu-Densoform, and Nu-weld form the group of higher strength. The difference in load at failure between these two groups is approximately 400 Gm.

3. There is a significant decrease in strength — approximately 400 Gm. — when the self-curing resin is packed at stage 2 rather than at stage 1. A further decrease is observed when packing is done at stage 3, repairing denture acrylic resin, but the evidence for this further decrease is not conclusive. In repairing the other two heat-curing resins there is no significant difference between stages 2 and 3.

The curves in Figure 6 show that the original resins were stiffer than the heat-cured repairs, which were in turn stiffer than the self-cured repairs. The end points of the curves are the average loads in failure.

The three curves in Figure 7 depict the average deflections obtained on specimens repaired with the self-curing resins at three different stages of plasticity. The differences in loads required for failure can be seen in this graph. There was no significant difference in the stiffness of the repairs made at the three stages of packing.

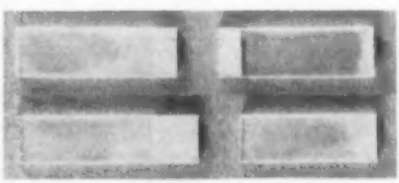


Fig. 5 • Typical breaks of repaired resin specimens. Specimen at top was repaired with heat-curing resin; specimen at bottom, with self-curing resin

Table 4 • Strength in transverse bending of specimens repaired with self-curing resins

Plasticity stages (see Table 5)	Clear heat-curing resins used for specimen plates	Transverse strength of specimen plates repaired with pink self-curing resins					
		Biofast	Duz-All	Fastcure	Nu-Densoform	Nuweld	Average
		Gm.	Gm.	Gm.	Gm.	Gm.	Gm.
1	Acralite	3,000	4,100	4,200	4,000	4,500	4,000
	Certified	3,700	3,900	3,800	4,100	4,100	3,900
	Denture Acrylic	3,800	3,100	4,400	4,200	4,000	3,900
	Average	3,500	3,700	4,100	4,100	4,200	3,900
2	Acralite	3,700	3,400	3,400	3,300	4,400	3,600
	Certified	3,500	3,000	3,600	3,800	3,700	3,500
	Denture Acrylic	2,500	2,900	3,800	3,400	3,800	3,300
	Average	3,200	3,100	3,600	3,500	4,000	3,500
3	Acralite	3,500	3,800	3,500	4,100	3,600	3,700
	Certified	3,400	2,900	3,500	3,500	3,300	3,300
	Denture Acrylic	3,100	2,300	2,700	2,800	2,800	2,700
	Average	3,300	3,000	3,200	3,500	3,200	3,200
	Average of all stages	3,300	3,300	3,600	3,700	3,800	

CHANGE IN DIMENSION ON REPAIR

The changes in dimensions of 11 upper dentures repaired by different materials and technics were determined by the following procedure: Stainless steel pins, having cross marks on them, were inserted into the second molars. A gypsum model was made of the tissue-borne surface of each denture, and the molar-to-molar dimensions were determined with a toolmaker's microscope. Each denture was cut through the center from the central incisors to the posterior margin by a band saw. Approximately an eighth inch was removed from each half. The sections were then seated on the tin-foiled model and the molar-to-molar distance was again measured.

In the heat-cured repairs, the process was carried out in the conventional dental manner of investing and packing. Three of the dentures were repaired by heating for one and a half hours at 73 ± 1°C. (163.4 ± 1.8°F.) after which they were placed in boiling water for ½ hour. Three additional dentures were repaired by heating at 73 ± 1°C. (163.4 ± 1.8°F.) for eight hours. At the completion of the curing cycles the flasks were bench cooled for 30 minutes in air and then immersed in water [23 ± 10°C.

Table 5 • Strength in transverse bending of repaired resin specimens

Material			Number specimens	Average load required for failure†
				Gm.
Original resins unrepaired			15	6,600
Original resins repaired with heat-curing resins.			45	5,400
	Stage	Average time*		
		min.		
Original resins repaired with self-curing resins.	1	2½	75	3,900
	2	4½	75	3,500
	3	7½	75	3,200

*Elapsed time from the beginning of the mix to completion of the packing of the repair.
†Standard deviation of a single determination is approximately 200 Gm.

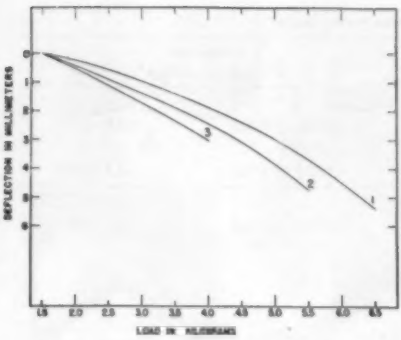


Fig. 6 • Transverse test on original and repaired specimens. 1. Original resins, unrepaired. 2. Original resins, repaired with heat-curing resins. 3. Original resins, repaired with self-curing resins (stage 1)

(73 ± 18°F.)] for 15 minutes. The flasks were opened and the molar-to-molar dimensions were measured before and after removing the repaired denture from the model.

Five dentures that had been cut in two and replaced on their respective models were repaired using the five self-curing resins. These repairs were effected by using a gypsum matrix of the lingual side of the unbroken denture. The matrix was held in place by a C clamp during the curing process. The self-curing resins were packed at the optimum time from beginning of mix so that they would have their greatest possible strength (stage 1 in Table 4). After the repairs had been completed, the dentures were again measured.

The dimensional changes in dentures repaired by the foregoing procedures are shown in Table 6. The values are the differences between measurements of the unbroken and the repaired dentures. The average change for the dentures repaired with the heat-curing resins that were boiled during the curing cycle was approximately two and a half times the change taking place in the dentures repaired with the heat-curing resins that were heated for eight hours at 73 ± 1°C. (163.4 ± 1.8°F.). This supports the general observation made at the beginning of this paper that the heating of the flask causes a definite strain in the high-expanding resin during confinement in the low-expanding plaster of paris mold. This strain was probably relieved in the form of dimensional change as shown by the data in Table 6. The changes in the artificial dentures repaired with the heat-curing resins were in the minus direction; that is, the molar-to-molar dimensions were smaller than originally. The changes that took place in molar-to-molar dimensions in dentures repaired with the self-curing resins, however, were in the plus direction. If the minus changes in the dentures repaired with the heat-curing resins held at 73°C. (163.4°F.) for eight hours are compared with the plus changes in the dentures repaired with the self-curing resins, it will be noted that the changes are of the same order of magnitude. There is, however, considerable difference in the fit of the repaired dentures when they are reseated on the gypsum models (Fig. 8). Invariably the dentures repaired by the self-curing resins fit the

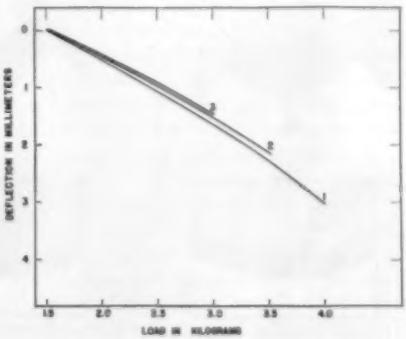


Fig. 7 • Transverse test on specimens repaired with self-curing resins. Curves are average for three packing stages. 1. First stage. 2. Second stage. 3. Third stage

Table 6 • Dimensional changes occurring in artificial dentures during repair

Type of repair resin	Number of dentures	Heating schedule	Average dimensional change*	
			in.	%
Heat-curing	3	1½ hr. at 73°C. · ½ hr. at 100°C.	−0.013 ±0.002	−0.8 ±0.1
	3	8 hr. at 73°C.	−0.005 ±0.000	−0.3 ±0.0
Self-curing	5	15 min. at room temp. 20–25°C.	+0.003 ±0.002	+0.2 ±0.1

*Degree of variation is expressed as average deviation.

model much better than any dentures repaired with heat-curing technics and resins. The lower stiffness of the self-curing resins may be an important factor in this behavior. When the 11 dentures which were repaired were handed to an observer as unknowns, they were sorted correctly in the categories A, B and C (Fig. 8 and 9). The repaired dentures shown in Figure 8 and 9 are typical.

SUMMARY AND CONCLUSIONS

Some physical properties of five self-curing resins marketed for repair of artificial dentures were measured using the test methods of American Dental Association Specification No. 12 for Denture Base Resins[1] (Type II, self-curing resins). These properties were compared with those of three heat-curing denture base resins.

The working plasticity of the self-curing resins was attained in from 3.5 to 4.5 minutes after beginning the mix, while 18 minutes were required on the average for the three heat-curing resins. The self-curing resins maintained a suitable working plasticity for at least 5 minutes. This is sufficient time to trial pack properly.

One of the self-curing resins had small

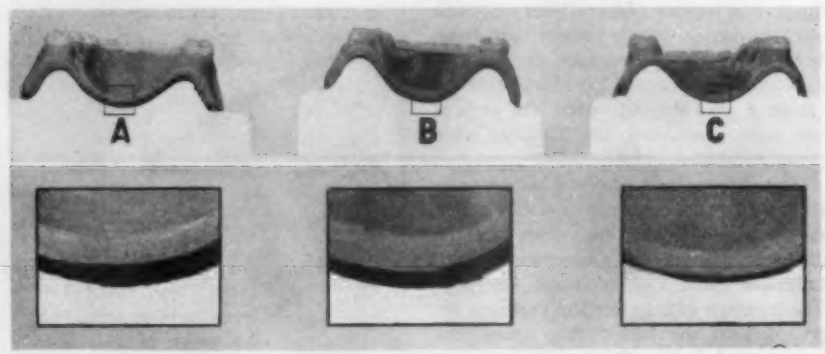


Fig. 8 • Warpage of artificial dentures during repair, posterior view. A. Heat-curing repair for one and a half hours at 73°C. (163.4°F.) plus a half hour boiling. B. Heat-curing repair for eight hours at 73°C. (163.4°F.). C. Self-curing repair for one quarter hour at room temperature, 20-25°C. (68-77°F.). Areas shown in lower half of figure are magnified

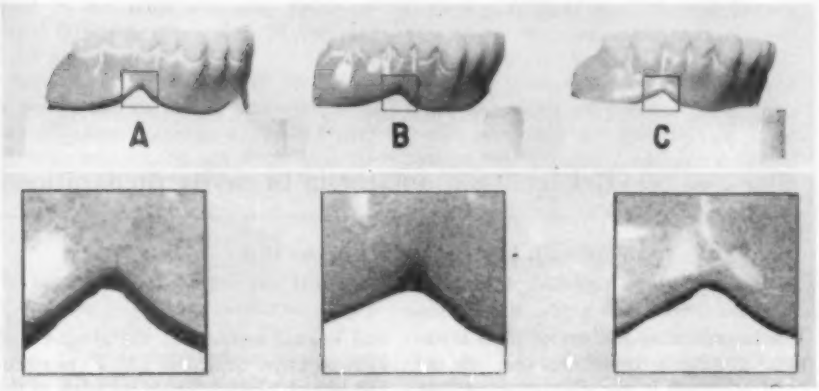


Fig. 9 • Warpage of artificial dentures during repair, left buccal view. A. Heat-curing repair for one and a half hours at 73°C. (163.4°F.) plus a half hour boiling. B. Heat-curing repair for eight hours at 73°C. (163.4°F.). C. Self-curing repair for one quarter hour at room temperature, 20-25°C. (68-77°F.). Areas shown in lower half of figure are magnified

bubbles or voids. None of the heat-curing resins was porous.

There were no significant differences in water sorption and solubility between the self-curing and heat-curing types.

Three of the self-curing resins failed to pass the color stability test of American Dental Association Specification No. 12.[1] One discolored so slightly that the change in color was barely perceptible. The remaining resin easily complied with the specification.

All the self-curing resins were weaker and less stiff than the heat-curing resins in transverse bending.

The average strength in transverse bending of specimens repaired by heat-curing resin was approximately 80 per cent of the original strength of the denture base resins. If the repair was made with the self-curing resins, the average strength was approximately 60 per cent when the optimum technic was used. In general, the optimum technic is to pack the self-curing repair resin so that the elapsed time from the beginning of the mix to the completion of the packing is 2 to 3 minutes.

There was a change of —0.8 per cent in the molar-to-molar dimension of full upper dentures repaired by heat-curing resins that were heated in boiling water during processing. If, instead of boiling, the repairs were heated at 73°C. (163.4°F.) for eight hours, the shrinkage was reduced to 0.3 per cent. There was an increase of 0.2 per cent in the molar-to-molar distance when the repairs were made with self-curing resins. Although there may appear to be only an insignificant difference between a —0.3 and a +0.2 per cent change in the molar-to-molar distance, the fit of the dentures repaired by the self-curing resins when reseated on the original gypsum models was invariably much better than the fit of the dentures repaired with the heat-curing resins.

Refrigeration anesthesia in cavity preparation

Robert J. Eustice, D.M.D., Biloxi, Miss.

The introduction and use of local injection anesthesia constitute one of the great advances in the alleviation of pain during dental operations. Local injection anesthesia, however, is not the complete answer to all problems of dental anesthesia. Some persons fear the thought of an injection despite the initial use of excellent topical anesthetics. Occasionally, a patient who has a history of a cardiac disease is a risk for an anesthetic containing a vasoconstrictor.

Patients with prior sensitivity to one or more local anesthetics are also poor candidates for injection anesthesia. The purpose of this paper is to present a preliminary report describing the use of a refrigerant type of anesthetic in cavity preparations which eliminates most of the need for a local injection.

The Hibernator machine used in this study was developed and manufactured in France; its trial use at the U.S. Naval Dental School was made possible through the courtesy of Dr. Pierre D. Bernard of Paris, France.

As early as 1863 Oudry[1] described an apparatus for cooling teeth prior to extraction. Allen[2] in 1942 stated that he noted no harmful effect in the tissues of a normal human limb held at temperatures slightly above freezing unless the low temperatures were continued for several days.

In 1944 Restarski[3] achieved anesthesia of dental structures by cooling the tissues. He applied an apparatus to the buccal and lingual surfaces of the gingiva and allowed brine chilled to 33° F. to circulate, which blocked nerve impulses to the teeth. After tests on animals indicated no resulting difference in cellular structure, he tested the apparatus on human subjects; in 68 per cent of the operations, there was complete anesthesia during cavity preparation.

Other investigators have applied the cooling to the dental bur instead of the tissues, in the belief that frictional heat is the primary cause of pain during cavity preparations. The thermal type spray, commonly used today, cools the dental bur only to the temperature of the water spray, or approximately 60° F. in a room air temperature of 80° F. Thomas,[4] using a specially constructed handpiece, cooled the bur to 0° F. or lower by evaporation of liquid carbon dioxide. In a study made he reported pain eliminated in 14 per cent and reduced in 63 per cent of the cavity preparations. In another study

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Formerly, Lieutenant (j.g.), Dental Corps, U. S. Navy Reserve. Assistant, operative dental service, U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md.

At present, in private practice.

1. Oudry, E. Improvement in apparatus for cooling the teeth. U. S. Patent Office, Spec. No. 39:673 Aug. 25, 1863.

2. Allen, F. M. Reduced temperatures in surgery. Am. J. Surg. 55:451 March 1942.

3. Restarski, J. S. Dental anesthesia induced by local refrigeration. J.A.D.A. 31:599 May 1944.

4. Thomas, B. O. A. Effectiveness of chilled burs in eliminating pain. J. D. Res. 30:361 Aug. 1941.

based on the same principle, Fritz[5] reported favorable reaction in 94 per cent of the preparations.

Restarski and Thomas both noted that an abrupt rise or fall in temperature in the applicator that was in contact with the oral mucosa caused a painful response.

INVESTIGATION PROCEDURE

This investigation utilized the Hibernator machine to develop anesthesia during cavity preparation.

The patients involved were not selected, but were taken as they called at the clinic for operative dental treatment. Among them were those whose medical histories showed that the use of injection type anesthetic agents was contraindicated. Typical case histories follow:

Case 1 • A 37 year old flier, who had been hospitalized two months previously for a coronary attack, was apprehensive and stated that he could not take a local injection for anesthesia. The refrigerant method was used to produce anesthesia and the patient was extremely satisfied; he stated that it was the pleasantest dental operative work he had ever experienced.

Case 2 • A 46 year old man, who was hospitalized for a severe chronic arthritis and was being treated with 50 mg. of cortisone daily, noted no sensation and reported a favorable reaction to the refrigerant anesthetic used.

Case 3 • A man, aged 53, had diabetes which was under control. His last dental treatment had been received at another place, at which a local injection anesthetic had resulted in a heart attack that lasted for six days. The cavity was prepared by using the refrigerant machine. The patient stated that he felt no pain, and that it was the most pleasant operative procedure he had ever experienced.

Case 4 • A flier, aged 45, had been a P.O.W. for two years. He had returned to this country 30 days prior to treatment. He was extremely nervous, and stated that after all previous local anesthetic injections he had fainted. The patient was extremely pleased with the new technic. He reported only a slight sensation during anesthesia.

Case 5 • A man, aged 20, was sensitive to procaine. When the refrigerant was used, he felt only a slight sensation. The patient suffered no ill after-effects, and was well pleased with refrigerant type anesthesia.

The machine, shown in the illustration, consists of a mobile cabinet (F), similar in size to an Airdent unit; it houses a refrigerant unit and a heating element. The machine has an arm which supports an air gun (A). The air gun directs a concentrated stream of air through a glass extension tube to the tooth which is undergoing cavity preparation.

Positioned on the air gun are a temperature indicator (B), a glass extension tube (C), a heating control button (D), and an air control lever (E).

The machine is employed for both methods previously mentioned to produce dental anesthesia; that is, it first gradually cools the tooth to approximately 1° C. (33.8° F.) and maintains that temperature; at the same time it cools the dental bur during cavity preparation. This progressive and moderate lowering of the temperature of living tissues has aptly been termed "hibernation" by the French.

The progressive temperature lowering of living tissue in hibernating animals has been studied by Robinson.[6] It differs

5. Fritz, J. R. Refrigeration anesthesia in cavity preparation; the WaRoPa method. Internat. J. Anesth. 1:49 Sept. 1953.

6. Robinson, S. Physiological effects of heat and cold. Ann. Rev. Physiol. 14:73, 1952.

Refrigeration unit in position. A, air gun attached to supporting arm (not seen in this view). B, temperature indicator. C, glass extension tubing positioned so as to cool primarily first and second molars. D, button for operating heating element. E, switch for controlling air output. F, cabinet which houses refrigerant and heating element. G, extension tubing carrying forced air from cabinet unit to air gun. (The patient's eyes are covered for nonidentification purposes only)

from two other procedures for cooling; namely, (1) rapid, intense cooling which freezes and kills tissues (Allen[7]), and (2) moderate, rapid cooling (Horton[8]), which initiates compensating reactions whereby the tissue becomes ischemic so quickly that there is evidence of vascular changes. The immediate reaction on temperature rise is hyperemia. Both these procedures have serious consequences. The first kills tissue, and the second results in localized congestion and edema, which are injurious to the tissues. Hibernation, on the other hand, results in a gradual lowering of tissue reaction, and there is no paralysis of the thermic centers.

It is known that much pain results when air at a temperature of 60° to 65° F. is blown against hypersensitive dentin. To prevent this, air at about 98.6° F. (body temperature) is blown on the tooth to be prepared after the air gun is in position, and the temperature of the air stream is slowly decreased automatically, yet imperceptibly, without stimulating neurosensitivity and congestive reflexes. At 59° F. the hypoanesthesia phase is entered. The temperature continues to decrease, and below 50° F. the anesthesia phase is reached. Anesthesia is sometimes sufficient at 41° F., and almost always at 33.8° F. (1° C.), for painless cavity preparation. The temperature of the air stream is stabilized automatically at 33.8° F. (1° C.) by a heating element housed in the cabinet. The length of time required to drop the air stream from 98.6° F. (body temperature) to 33.8° F. (1° C.) is approximately two minutes. The stream of air is maintained at 33.8° F. throughout the operation. The dental bur, as well as the tooth, is in the direct line of the refrigerated air stream.

With this type of refrigerant anesthesia it was found mandatory to use the rubber dam, for without it the constant cold air stream was irritating to the patient's pharynx. The glass extension tube must be placed so that it is within a half inch of the tooth to be prepared, and at an angle that does not interfere with access during cavity preparation. In some instances of cavity preparation, this was difficult, especially in those involving third, and sometimes second, molar regions, in patients with small mouths. After repeated use of the

7. Allen, F. M. Broader aspects of refrigeration anesthesia. Anesth. & Analg. 24:51 March-April 1945.
8. Horton, S. H. Cold injury. U. S. Armed Forces M. J. 3:825 June 1952.

machine, however, the positioning of the tube and the patient can be done with much greater ease.

Cavity preparation was begun without the machine in position. When the patient registered a definite pain response, the machine was placed in position and the air stream temperature allowed to drop to 33.8° F. (1° C.) and remain at this temperature approximately one to two minutes before the cavity preparation was continued. It was during this phase of the cavity preparation that observations and patient reactions to the degree of anesthesia were recorded. If the patient exhibited a pain response during the cavity preparation which was accomplished under refrigerant anesthesia, he was asked to note its degree, whether slight, moderate or severe. Later, after the treatment was completed, he was asked to report on his pain reactions, and also on his general attitude toward this type of anesthesia.

At the end of the cavity preparation, the air stream was warmed again gradually, and then shut off, thus preventing an abrupt rise in temperature on the tooth which would give a painful reaction. The time of rise to 98° F. approximated 50 seconds, after which the machine was removed. Patients normally demonstrated a painful response to a stimulation within the prepared cavity. It was noted that normal pain response did not return in some patients for a period of five to 10 minutes. The very few who failed to exhibit any pain response during the remainder of the treatment are not included in the tabulation of investigation results.

RESULTS

The reports of 100 patients, together with the classifications of teeth prepared and groupings of times the machine was in operation, are given in the table. The severity of pain sensations is noted, and the general reaction of the patient toward this type of anesthesia is indicated. Among those indicating a slight pain, many reported only a sensation which could hardly be described as painful. The patients were men and women, ranging in age from 20 to 68.

CONCLUSIONS

1. Ninety-four per cent of the patients in whom refrigerant anesthesia was used reported favorable reaction with little or no pain during cavity preparation.

2. Six per cent indicated a pain reaction and reported unfavorable reaction.

3. Those tested who had little or no pain developed a favorable attitude and vice versa.

4. In the 6 per cent of the patients

Table • Reports of 100 patients

Classification of tooth	No. operations	Length in min. of machine operation			Pain sensations				Patients' reactions	
		1–6	7–12	13–18	None	Slight	Mod.	Severe	Favorable	Not favorable
Molars	29	9	17	3	18	5	3	3	23	6
Bicuspids	27	6	12	9	22	5	0	0	27	0
Incisors	44	26	17	1	36	8	0	0	44	0
Total	100				76	18	3	3	94	6

who experienced a pain reaction, the cavity preparations were in the following teeth: three in third molars and one in a second molar in the maxilla; two in the third molar in the mandible.

5. The total number of molars treated was 29. Unrecorded observations indicated that in patients with wide mouth openings it was much easier to place equipment so that the air stream would be in a correct position to accomplish anesthesia. Conversely, it was noted that small mouths interfered tremendously with accessibility, especially for upper third molars.

6. Unfavorable reactions to refrigerant anesthesia were not due to the technic of anesthesia, but to inadequate accessibility.

7. Further investigation is recommended so that a new technic can be developed for treating posterior teeth.

SUMMARY

This investigation inquired into the effectiveness of a refrigerant anesthesia achieved by a progressive moderate lowering of tissue temperature. The observation in treatment of 100 cavity preparations indicated anesthesia was effective, and the patient was satisfied in 94 per cent of the treatments. The observations also indicated that the unsatisfactory results were due more to inaccessibility than to any lack of effectiveness of the refrigerant anesthesia.

316 Delaunay

The role of endodontics in complete mouth reconstruction

Samuel Seltzer, D.D.S., Philadelphia

The increasing awareness of the dental profession that diagnosis and treatment should be based on the occlusion of the teeth of the patient, rather than on the individual tooth defect, has brought into prominence a procedure called "complete mouth reconstruction." This procedure is also known as "mouth rehabilitation," "oral dynamics," "oral orthopedics," and "jaw repositioning." These terms are probably synonymous with the old terms "bite correction" or "bite opening." Each of these procedures is based on different theories, mechanical means and technics; consequently, the occlusions are rebuilt differently in each case. Common to all attempts at rebuilding the occlusion by fixed appliances, however, is the preparation of some or all of the teeth for full cast veneer crowns. Before this is done, or often as a sequel to it, the pulps of some of these teeth will be jeopardized. Inevitably, therefore, a tooth with actual or potential pulp involvement must assume a critical role in the diagnosis and treatment planning for every mouth in which reconstruction of the occlusion is contemplated.

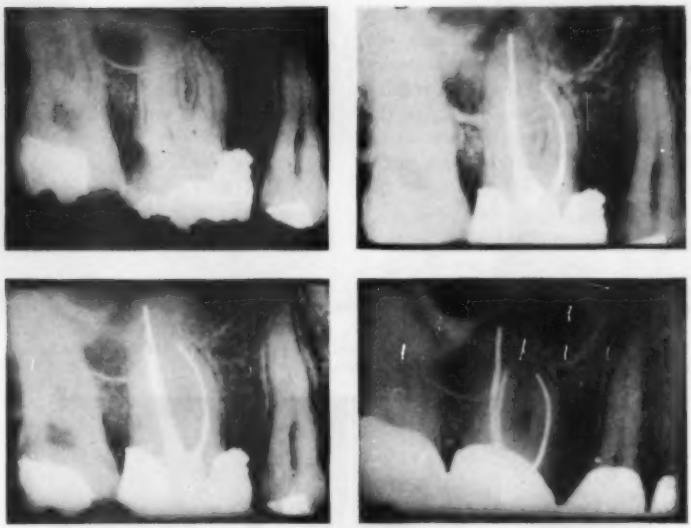


Fig. 1 • Endodontics before occlusal reconstruction. Above left: Preoperative roentgenogram showing large carious lesion on distal aspect with overhanging mesioocclusal amalgam. Above right: Roentgenogram taken immediately after completion of root canal therapy. Canals are filled with silver points. Below left: Roentgenograms taken six months later. Below right: Two years after root canal therapy had been completed

Mouths requiring complete occlusal reconstruction have been grouped under a variety of headings. Generally speaking, however, they may be included in two main classifications: (1) those exhibiting periodontal involvement due to one or more of the following conditions: loss of posterior support, steep cuspal inclines, deep overbite or malocclusion; and (2) those in which most or all of the teeth are afflicted with extensive caries of crown or root or both and those exhibiting considerable attrition.

Regardless of the classification, all mouths requiring complete mouth reconstruction will have teeth which are candidates for endodontic treatment either before, during or after the reconstruction procedures are completed.

Before the operative procedures are begun, pulps may be endangered or involved because of deep-seated carious lesions, certain restorative procedures, attrition, abrasion or erosion. Figure 1 shows an instance of endodontic treatment before occlusal reconstruction for a patient who had complained of pain in the upper right first molar. Clinical diagnosis of acute suppurative pulpitis had been made.

Deep periodontal pockets may cause exposure of lateral canals situated close to the bifurcation of a molar and result in pulpal inflammation. Necrotic pulps of long standing may remain undetected unless pulp testing procedures are employed. Chronic periapical lesions, if present, will be discovered by the routine full-mouth roentgenographic examination.

During the operative procedures, pulps may be exposed mechanically when extruded teeth are reduced or walls paral-

leled. Such a situation is illustrated in Figure 2. The patient, a 42 year old woman, had six remaining lower anterior teeth which had been filled and refilled many times. It was decided to splint the anterior teeth and construct a partial denture supplying the posterior teeth. During veneer crown preparations, the second incisor and cuspid on both sides were found to have pulp exposures. Extraction of these teeth would have necessitated the construction of a full lower denture, to which the patient was much opposed; she was therefore referred for root canal therapy.

Pulps may become inflamed because of the heat produced by rapid cutting technics. During preparation of the teeth, large areas of dentin are uncovered and millions of freshly cut dentinal tubules are suddenly exposed to oral fluids and thermal irritation. These teeth are usually protected by temporary crowns and bridges which often become loosened under masticatory stress with subsequent washing out of the temporary cements.

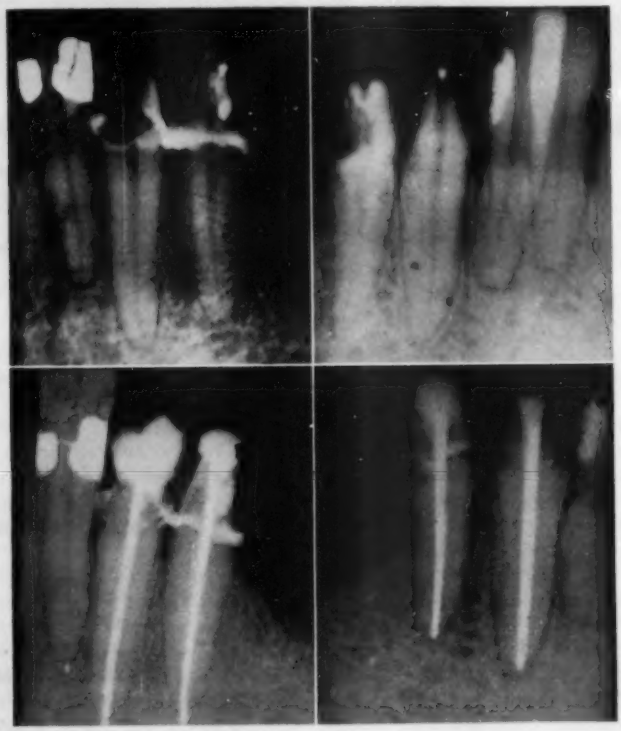


Fig. 2 • Endodontics during occlusal reconstruction. Above left: Lower right lateral incisor and cuspid before endodontic treatment. Above right: Lower left lateral incisor and cuspid after pulp exposure. Below left: Completed root canal therapy on lower right lateral incisor and cuspid. Below right: Lower left lateral incisor and cuspid after root canal therapy

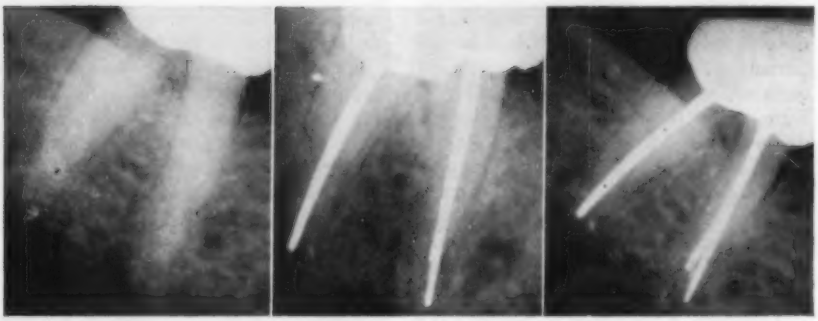


Fig. 3 • Endodontics after occlusal reconstruction. Left: Roentgenogram showing canals clogged with bits of metal. Center: Completed root canal therapy. Right: Check-up roentgenogram one year later

The resulting irritation often ends in pulpal inflammation and eventually in pulpal death. The cements themselves may be sufficiently irritating to cause pulpitis.

After the reconstruction is completed and the crowns and bridges have been cemented permanently in place, pulps which have been on the borderline between hyperemia and pulpitis may suddenly become acutely inflamed. Figure 3 illustrates an instance in which, six months after the crowns had been cemented, the patient complained of a dull ache in the lower left third molar. Within several days the pain had become severe, especially at night. Heat made the pain more intense. The diagnosis of acute suppurative pulpitis was made. Because extraction of this tooth would have necessitated the construction of a partial denture with a free end saddle, root canal therapy was decided upon. During the course of the treatment, the dentist had clogged the root canals with molten metal. The patient was referred for completion of root canal therapy; after intensive reaming and filing with sharp instruments, the obstructions were removed and the canals sterilized and filled.

A tooth with a heretofore undetected necrotic pulp may suddenly "flare up." Roentgenographic examination at this time may also disclose periapical lesions which had not existed previously. Pulp or periapical involvement may take place months or years after the occlusion has been rebuilt. Finally, an undetected premature contact could cause pulpitis at any time after the occlusion has been reconstructed.

Should pulp or periapical involvement occur during the time that the reconstruction was being done, the entire plan of treatment might have to be altered, unless endodontic treatment could be accomplished successfully. Figure 4 shows an example of such a case. The patient, during the course of occlusal reconstruction, developed a severe toothache in the upper right first molar. Pain developed spontaneously, but was aggravated by cold. A diagnosis of acute serous pulpitis was made. Since the upper right second molar was mobile because of periodontal disease, it was not dependable as a distal abutment. Therefore, retention of the upper right first molar was important strategically.

After a reconstruction has been completed, a tooth with pulp or periapical involvement which could not be treated

successfully by endodontic therapy would have to be extracted. This would be extremely difficult to perform with splinted teeth unless all the crowns were removed. Even under the most favorable circumstances, the reconstructed occlusion would be partially or totally destroyed. This would not only cause embarrassment to the operator, but, even worse, the patient would lose money and time and would be subjected to a great deal of pain and discomfort needlessly.

Therefore, a knowledge of endodontics and an ability to perform it are as important to the operator as his technical skill in the preparation of a full cast crown. Without a command of as well as utilization of endodontics, the entire treatment plan will be placed in jeopardy just as surely as it would be by the insertion of an improperly fitting or improperly contoured crown. The dentist must believe in the efficacy of endodontic therapy and have confidence in the successful outcome of treatment.

Fortunately, modern endodontic procedures in which combined antibiotic and fungicidal therapy are utilized are safe, efficient and dependable. Otherwise, complete mouth reconstruction would be extremely hazardous.

SELECTION OF TEETH FOR ENDODONTIC TREATMENT

The selection of teeth for endodontic therapy in occlusal reconstruction is governed by several general factors. The requirements for successful endodontic treatment are as follows:

1. The operator must possess skill and experience. Perhaps this is the most important general factor. Unless the dentist is confident that he can treat the tooth successfully, he should not attempt it;

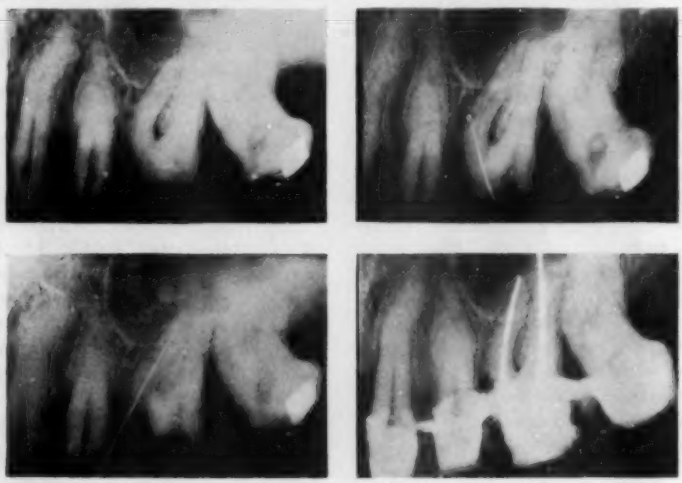


Fig. 4 • Necessity for endodontic therapy to avoid change of treatment plan. Above left: Roentgenogram at time of pulpitis. Above right: Because of the curvature of mesiobuccal root, the no. 1 reamer was unable to negotiate the canal. As much as possible of the clinical crown was sliced medially so as to obtain a more direct approach to the mesiobuccal canal. Below left: Reamer is able to negotiate canal to apex. Below right: Root canal therapy completed

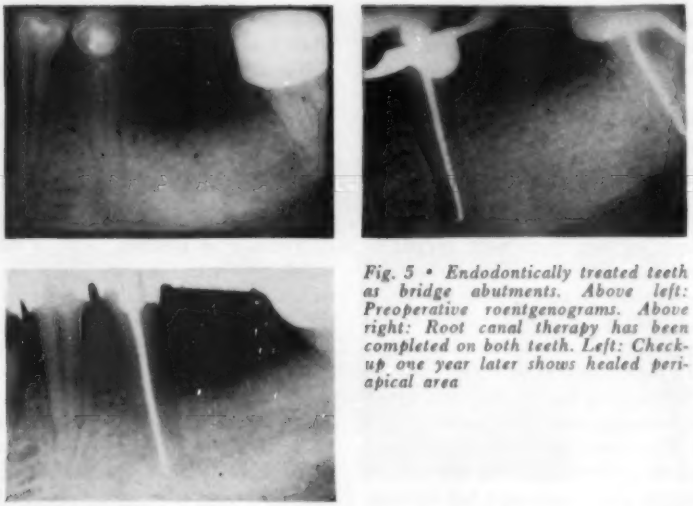


Fig. 5 • Endodontically treated teeth as bridge abutments. Above left: Preoperative roentgenograms. Above right: Root canal therapy has been completed on both teeth. Left: Check-up one year later shows healed periapical area

the stakes are too high. It would be much better to refer the patient for this phase of treatment to someone more skilled, or, if such an individual is unavailable, to extract the tooth, rather than gamble the outcome of the entire procedure on one questionable tooth.

2. The patient's health must be good. It is assumed that patients would not be undergoing occlusal reconstruction unless they were free of systemic disease or such disease, if present, were under control. Where systemic disease is present, pulp or periapical infections may have been a factor in causing the disease. Also, repair or healing of periapical tissues takes place slowly or not at all. Hence, patients with chronic debilitating disease are poor risks for root canal therapy.

3. The strategic value of the tooth must be high. When bridges or partial dentures are to be constructed, the question of whether to extract a tooth and replace it or to treat it endodontically and use it as an abutment must be resolved by determining the strategic value of the tooth. It is generally agreed in dentistry that, all other considerations being equal, fixed bridgework is the restoration of choice rather than a partial denture. Therefore, a tooth becomes strategic if the following questions concerning it can be answered affirmatively: (a) From the periodontal standpoint, can the tooth be used as an abutment for a fixed bridge? (b) Will the loss of the tooth necessitate the construction of a partial denture rather than a fixed bridge?

If the answers are "Yes," endodontic treatment should be instituted, provided the qualifications listed later are met. In Figure 5 the lower right bicuspid had a periapical region of rarefaction and the lower right molar developed acute pulpitis. These teeth could have been extracted and a partial denture constructed. Instead, it was decided to treat the endodontically involved teeth and construct a fixed bridge.

If a partial denture is to be constructed, a strategic tooth would be one about which the following questions could be answered in the affirmative: (1) From the periodontal standpoint can the tooth be used as an abutment for a partial denture? (2) Will the loss of this tooth

necessitate the construction of a full denture rather than a partial denture?

If the answers to these questions are "Yes," endodontic treatment should be instituted provided the necessary qualifications are met. In some instances, the difference between the construction of a partial denture or a full denture will depend on the ability of the operator to retain one or two teeth with pulpal or periapical involvements. The endodontic treatment depicted in Figure 6 was given a young man who had lost most of his teeth prematurely. Only five teeth remained in the maxilla; of these, two, the upper left lateral incisor and the upper left first bicuspid, were endodontically involved. Their loss would necessitate construction of a full denture. As the patient preferred to avoid wearing a full denture, root canal therapy was performed for the involved teeth.

If the loss of involved teeth and the wearing of a full denture are psychologically traumatic to the patient, the remaining teeth assume strategic importance and endodontic treatment should be attempted. Endodontic treatment is also of importance for the remaining teeth of those patients who gag easily when the palate is covered.

In patients with cleft palate, every maxillary tooth is strategic.

RETENTION OF TEETH STRATEGIC TO OCCLUSION

Special emphasis should be placed on the importance of treating, with a view toward retaining *in situ*, certain teeth which are strategically important from the standpoint of maintaining the occlusion. These teeth are categorized as follows:

All Cuspids • Every effort should be made to treat cuspids endodontically if there is evidence of pulp or periapical disease. This is true regardless of whether or not a fixed bridge or partial denture is to be constructed. The cuspid is not only a strong abutment; it is also an important buttress in maintaining the occlusion. It supports the corner of the mouth and resists the anterior component of force. Even if root resection must be performed, there is usually enough root structure left to permit the cuspid to

Fig. 6 • Left: Upper left lateral incisor with thickened periodontal membrane caused by previous poorly performed root canal therapy. Center: Upper left first bicuspid with necrotic pulp. Right: Completed root canal therapy

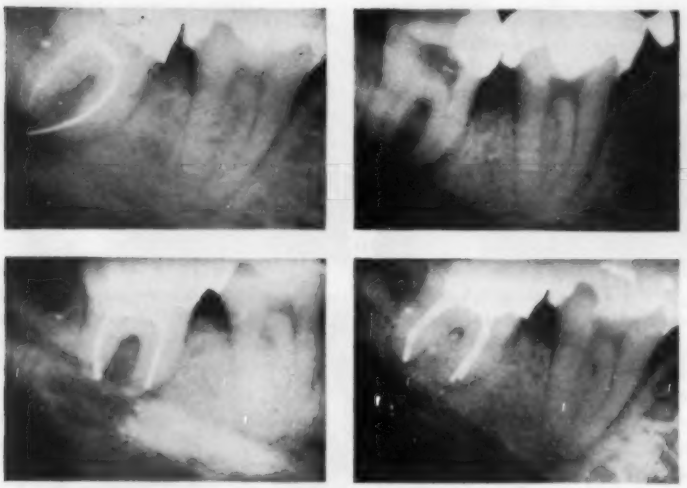


Fig. 7 • Retention of most distal molar in arch. Above left: Periapical radiolucent area around apex of lower left third molar. One medial canal has been overfilled, the other mesial canal apparently has been overlooked. Above right: Old root canal filling has been removed and the canals enlarged. Below left: Negative cultures were obtained and then the canals were filled. Below right: One year later, periapical bone repair has taken place

function as a firm anchor because of its long, strong root.

Most Distal Molar in the Arch • The most distal molar, whether it is in the maxilla or the mandible, is of strategic importance. Third molars are excluded from this category only if there is a full complement of teeth. Where there are other missing molars or bicuspids, retention of the most distal molar will often help determine whether to construct a fixed bridge or a partial denture. Of even greater importance, however, is that, if other molars have already been lost, the extraction of the distal molar will necessitate the construction of a denture with a free end saddle. This type of denture is less satisfactory than one in which the saddle area is supported by natural teeth at both ends of the span. An example of this is one in which all the teeth are present except for the lower first permanent molar which has been extracted at an early age and not replaced. The lower second and third molars have erupted anteriorly and mesially inclined to their normal position. The lower third molar is a strategic tooth because, if it is lost, both the upper second and third molar will be inactivated. Here, endodontic therapy is necessary if the pulp of the lower third molar becomes involved because extraction of this tooth will necessitate the construction of a cumbersome lingual bar denture for the replacement of one tooth.

Figure 7 illustrates an instance where the most distal molar in the arch was retained. The lower left first molar had been lost at an early age. The lower left second and third molars had drifted mesially. The pulp of the lower left third molar had become involved, and a den-

tist, realizing the strategic value of this tooth, had performed root canal therapy. Five years later, an acute dentoalveolar abscess developed. Extraction would have inactivated the upper left second and third molars. It was decided, therefore, to treat the tooth again, and this was done successfully.

Any Remaining Posterior Tooth, Whose Loss Would Destroy Vertical Dimensions • Any remaining posterior tooth whose loss would destroy vertical dimension is strategically important. This is especially true of the last remaining posterior tooth on one side which is in contact with an antagonist, thereby maintaining vertical dimension. Retention of this tooth is of even greater importance if a change in the vertical dimension is contemplated.

All Remaining Teeth in Mouths in Which Advanced Periodontal Disease Is Present and Where Reconstruction Procedures Are Contemplated • When periodontal disease is present and reconstruction is to be instituted, every tooth becomes strategically important because each additional tooth extracted decreases the periodontal support. With continued loss of teeth a point is reached where the occlusal reconstruction can no longer be supported; in fact, the abutments become overloaded and therefore are soon lost.

QUALIFICATIONS FOR ENDODONTIC THERAPY

Before a tooth is chosen for endodontic treatment it should meet the following requirements:

1. It must permit maintenance of asepsis. There must be sufficient crown structure remaining to permit placement of the rubber dam. If so much tooth structure has been lost through decay that a rubber dam clamp cannot be placed, the maintenance of an aseptic technic becomes most difficult. The chances for successful endodontic therapy are therefore diminished. In some instances, a temporary crown can be placed on the tooth requiring treatment. If this can be done, and leakage of saliva into the root canal can be prevented, treatment has a better chance of success.

2. There must be sufficient crown structure remaining after completion of endodontic treatment to permit the preparation of a retentive restoration. In instances where it is not possible to utilize the tooth as an abutment, obviously, it is wasted effort to treat it. Many times the apical third of the root canal can be filled after treatment, thereby allowing room for a post in the rest of the root. This post can be used as an aid in retention.

3. There must be sufficient periodontal support to maintain the tooth in its alveolus. If an apicoectomy is performed, sufficient root must remain to support the tooth in its alveolus. The fulcrum of force on the tooth must not be at or close to the remaining apex, otherwise the use of this tooth as an abutment is contraindicated.

4. The root canals must be mechanically accessible, patent and penetrable to the apex. If, for example, the patient cannot open his mouth widely enough to allow introduction of instruments into the canals, it would be impossible to perform successful endodontic treatment even though the tooth were strategic. Where there is doubt as to whether root canal therapy can be accomplished successfully because of obstruction in the root canal or difficulties in gaining access, treatment should be completed before reconstruction procedures are begun so that this doubt may be resolved.

DEPENDABILITY OF ROOT-FILLED TEETH AS ABUTMENTS

A valid reason for questioning the reliability of a treated tooth as an abutment does not exist. Some dentists will

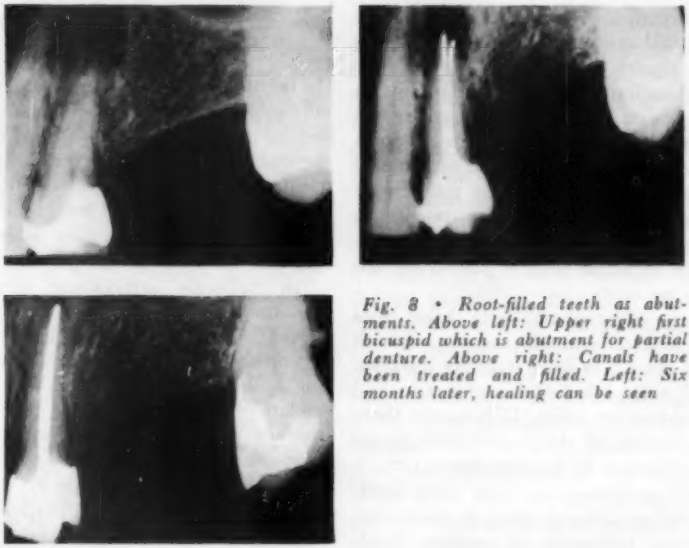


Fig. 8 • Root-filled teeth as abutments. Above left: Upper right first bicuspid which is abutment for partial denture. Above right: Canals have been treated and filled. Left: Six months later, healing can be seen

resort to endodontic treatment on anterior teeth for esthetic reasons or under circumstances where the loss of a tooth would not cause undue embarrassment should treatment fail. However, they are reluctant to depend on an endodontically treated tooth as a bridge or denture abutment. This reluctance probably stems from previous failures or from misconceptions concerning the reliability of a root-filled tooth.

Failures usually are due to lack of observance of the basic principles of root canal therapy. If an aseptic technic is not maintained, proper débridement of the root canal is not done, the tissues are not treated gently, or the root canal is not sealed hermetically, failure is to be expected regardless of the antibacterial potency of the medication employed. The use of antibiotics, however, has simplified treatment and reduced treatment time. Postoperative sequelae have been minimized or eliminated. Especially if a partial denture is worn, root canal therapy, rather than extraction, should be performed for abutment teeth (Fig. 8). The tooth can always be extracted if failure occurs. If a periapical region of rarefaction exists, a check-up in six months will reveal whether healing is taking place.

One objection to a root-filled tooth is its tendency to fracture. This is more likely to occur than is the fracture of the crown of a tooth with a living pulp. The dentin becomes more brittle once the pulp is removed. Fractures of cusps take place probably because there has been loss of dentin through caries and the enamel is unsupported. Also, more dentin must be removed in order to gain access to the pulp canals during therapy. The tendency to fracture can be eliminated or minimized by full crown coverage.

Should doubt exist as to whether a periapical region will develop in a treated tooth or whether a periapical region will heal, six months should be allowed to elapse after completion of endodontic treatment before beginning

reconstruction. At that time, roentgenograms will reveal the status of the periapical tissues. If repair is evident, the reconstruction can be started. Thus, a valid reason for failure to utilize an endodontically treated tooth as an abutment no longer exists. Indeed, removal of a strategic tooth that is pulpally or periapically involved often results in further loss of teeth because of the greater amount of stress that is placed on the remaining teeth.

Teeth with incompletely filled root canals are dependable as abutments if the fillings are of long standing duration and if the periodontal membrane and lamina dura are intact. If, however, there is thickening of the periodontal membrane revealed in the roentgenogram, it is safer procedure to treat these teeth again before utilizing them as abutments. A second treatment of pulpless teeth which contain posts in their roots can be accomplished by exposing the root end through a window in the bone. After curetting the involved region, a cavity is prepared in the root end and this is filled with amalgam. Even though parts of the root canal are not well filled, the sealing of the apical foramen by this method enables repair to follow.

PULP CAPPING AND PULPOTOMY

Mechanical or carious exposures made during veneer crown preparations cause the teeth to be poor risks for pulp capping or pulpotomy because they are invariably contaminated. Hence, these procedures are contraindicated in occlusal reconstruction. Pulp-capped or pulpotomized teeth of adults are not dependable. The remaining pulp may become inflamed at any time, especially after the irritation of grinding for veneer crown preparations. In addition, the pressure of impression bands and temporary crowns are conducive to pulpitis. Root canal therapy should be completed in advance of occlusal reconstruction.

CORRELATION OF ENDODONTICS WITH ORTHODONTICS

In occlusal reconstruction, it is frequently advisable to move teeth orthodontically before they are prepared for crowns. This procedure assures greater stability of malposed teeth. From the endodontic standpoint, it helps to avoid mechanical pulp exposure when the operator attempts to parallel the walls of the preparation.

In full-scale orthodontic treatment, endodontics often assumes a critical role. Retention of the molars is important to the orthodontist since these teeth are used for anchorage. Should the pulps of the molars become inflamed, root canal therapy can be performed with reasonable assurance that these teeth will be retained. Appliances should be removed from treated teeth with periapical involvement until healing has taken place. If stress is maintained on such a tooth, the periapical involvement may never be repaired and consequently the tooth may be lost.

If the orthodontic treatment plan dictates its retention, endodontic therapy can be utilized for any tooth, providing it meets the qualifications already listed. Root-filled teeth can be moved orthodontically with the same assurance as can teeth with living pulps.

LESIONS FOLLOWING OCCLUSAL RECONSTRUCTION

Once the occlusal reconstruction has been completed and cementation accomplished, the development of acute partial pulpitis in any tooth may be responsible for producing the severest kind of dental pain. This often presents a problem in diagnosis because all the ordinary tests cannot be made. The pulp tester is valueless when the teeth are covered by veneer crowns. Percussion is of questionable value because there is rigid fixation of units. Palpation is of no value until apical periodontitis develops.

Thermal tests are unreliable in the presence of veneer crowns. The roentgenogram will help only when the lesion has progressed to the stage where there is apical thickening of the periodontal membrane.

An acute partial pulpitis may defy detection for long periods of time. Referred pain, a common characteristic of acute pulpitis, frequently diverts attention from the offending tooth. Patients have been known to be treated by otolaryngologists for earaches and sinusitis, by neurologists for neuralgia, by ophthalmologists for eye pains and by internists for headaches when pulpitis was responsible for the pain. Once pulpitis involves the periodontal membrane, the pain begins to localize in the tooth which is responsible. After the pulp becomes necrotic, referred pain usually stops and the diagnosis becomes more apparent.

The referred pain itself may be used as a guide in locating the offending tooth.

Each tooth has a separate area of pain reference. Knowledge of these sites will be of value in determining which tooth is responsible. According to Head, the focal points to which pain from the teeth may be referred are as follows: The upper central and lateral incisors refer pain to the frontal region. The upper cuspids and first bicuspid refer pain to the nasolabial region. The upper second bicuspid refers pain to the temporal and maxillary regions. The upper first molar refers pain to the maxillary region. The upper second and third molars refer pain to the mandibular region. The lower incisors, cuspids and first bicuspid refer pain to the mental region. The lower second bicuspid refers pain to the hyoid or mental region. The lower first and second molars refer pain to the ear and behind the angle of the jaw. The lower third molar refers pain to the superior laryngeal region and to the ear.

Such a direct correlation does not always exist, however. Local anesthesia must then be employed as an aid in diagnosis. The patient should be given a mandibular block injection. If pain persists after the symptoms of anesthesia appear, the offending tooth is in the upper jaw. If the pain disappears with the onset of symptoms of anesthesia, the offending tooth is located in the mandible.

From the regions of referred pain, the location of the offending tooth can then be directed to one or two teeth. The offending tooth is usually the one with the deepest restoration. If doubt still exists, it is preferable to wait until the pain begins to localize, if the pain is endurable.

It is noteworthy that pulpitis never occurs simultaneously in more than one tooth, even though several teeth may consecutively become involved. Also, pain is never referred to the other side of the same jaw, although it may be referred from maxilla to mandible (or vice versa) on the same side.

MAINTENANCE OF ASEPSIS DURING ENDODONTIC THERAPY

One of the main reasons for failure of root canal therapy is lack of asepsis. This is an especially acute problem in dealing with teeth which have been prepared for veneer crowns. A tooth from which undercuts have been removed is a difficult one on which to place a rubber dam clamp. If saliva leaks into the operative field while root canal therapy is being performed, the operation is doomed to failure.

Compound cavities in teeth that are selected for endodontic therapy before the crown preparations are begun should be prepared and filled with amalgam as a prelude to treatment. This precludes the possibility of leakage of saliva into the root canal from the gingival margin. A badly broken down tooth should be covered with an aluminum crown.

When endodontic therapy becomes necessary during occlusal reconstruction, temporary acrylic splints must be dealt with as a rule. Root canal treatment

should never be attempted through an acrylic crown or splint which has been cemented on with a zinc oxide and eugenol preparation. Eugenol softens acrylic resin, with resultant porosity and subsequent leakage. Instead, these crowns should be cemented on with zinc oxyphosphate cement even if this means that the splint must be destroyed in order to remove it after endodontic therapy has been completed. Temporary crowns made of metal are preferable to acrylic crowns during root canal therapy and should be used whenever possible.

After the occlusal reconstruction is completed, endodontic treatment, of necessity, must be performed through an occlusal opening in the veneer crown. Inasmuch as orientation is lost because of the removal of the enamel and subsequent reshaping of the artificial crown, it is wise to drill for the largest canal orifices in the molars; that is, the lingual canal in the upper molars and the distal canal in the lower molars. In anterior teeth this problem is not as acute; nonetheless, extreme care must be exercised to avoid perforation.

In teeth which have had posts placed in their roots, apical curettage and sealing of the apical foramen, as already described, is the only procedure that can be employed.

Endodontic therapy can never be divorced from occlusal reconstruction. Together with periodontal therapy, these procedures open up new vistas in the never-ending struggle to preserve the natural dentition.

2035 Spruce Street

Pioneering for health: Grand Rapids' decade of progress in fluoridation as an example

Thomas Parran, M.D., Dr. P.H., Pittsburgh

During a period when so much serious conversation and too much contemporary editorial comment has to do with the possible partial or complete annihilation of this or succeeding generations, it warms one's heart to meet with good citizens like yourselves who have been steadfast to promote the better life, and who will face the grim problems of this mid-century with equal steadfastness when or if they confront us.

In this connection, a news item in last Sunday's *New York Times* gave me some "innocent merriment." It quoted from a recent speech by an official of the Food and Drug Administration in which he pointed out that existing appropriations were far too small to permit proper policing of either of the two industries involved. Among other illustrations he mentioned a quack who obviously was mislabeling his widely-sold patent nostrum and who stated that, in addition to other virtues of the product, "it postponed death until the last mo-

Delivered before the Detroit Dental Society, February 2, 1955, at the tenth celebration of fluoridation of Grand Rapids' water supply.

Formerly, Surgeon General of the United States; at present, dean, Graduate School of Public Health, University of Pittsburgh.

ment!" Here in Detroit I think we should give full credit to Grand Rapids for postponing dentures until the last moment.

This decade and this century have recorded many long advances in science and in its application for the improvement of human health. The event we are celebrating today will rank high on the list. For the first time, solid progress has been demonstrated in reducing the amount and the volume of dental caries, the most prevalent of the diseases affecting civilized man. What has been done in Grand Rapids, and later in many other communities, proves that through a simple and safe procedure this disease can be reduced by two thirds.

As I read the history of our search for knowledge regarding the relation between fluorine and dental caries, I find that as early as 1892 Sir J. Crichton-Browne in *The Lancet* drew attention to the phenomenon. The original observations of Frederick S. McKay of Colorado Springs acknowledged the earlier work when he reported, in 1916, the relationship between mottled enamel and the high prevalence of fluorine. These earlier reports stimulated the researches of Dr. Dean.

It is interesting to recall that the development of this public health procedure—fluoridation—has passed through several widely different manifestations over the decades. First was the era of concern because of the toxic manifestation; namely, mottled enamel, due to the ingestion of excessive amounts of water-borne fluorides during tooth development. Second was the period when observations were made of the ingestion of optimal amounts of naturally water-borne fluorides during tooth development which was found to result in sound teeth with a high resistance to decay. Third is the present era, during which it has become evident that by adding small amounts of fluorine to communal water supplies, which lacked this element, dental caries is significantly reduced without either public health hazard or any toxic result to the consumers.

You will remember that of many community actions undertaken to improve public health since the turn of the century, there has been loud opposition to each. When chlorine was first introduced into public water supplies, the Philistines clamored against adding this "poison" to our natural waters. When pasteurization was suggested for milk supplies there was widespread opposition to "cooking" this "natural food." Opponents included not only the uninformed public, but also a substantial group of physicians who insisted that natural milk was better and more nutritious than pasteurized or "cooked" milk. The pediatricians had a valid but very minor point. It is true that the proteins of milk are changed slightly through the process of pasteurization, but there has been little evidence that such changes are deleterious from a nutritional point of view.

The opponents of pasteurization and the opponents of water chlorination overlooked the all-important point: it was only through these measures that water and milk could be made safe for human consumption from a practical point of view. In city after city dramatic declines occurred in the high mortality rates from typhoid fever, dysentery and other filth-borne diseases. Cause and effect were clearly demonstrable. As a result, chlorination and pasteurization now are used almost universally to safeguard our public water and milk supplies.

As we celebrate the tenth anniversary of the pioneer endeavor to raise the fluorine content of the public water supply of Grand Rapids, it is encouraging to record that in the relatively few communities in which the content of fluorine naturally found in the community water supply is excessive and causes mottled enamel, measures are being applied to reduce the content to the optimal level of about 1 ppm.

I have stated repeatedly that the available facts support strongly the recommendation that the fluorine content of every public water supply should be adjusted to an optimal level. Taxpayers should realize that this involves engineering skill since this level varies with the average temperature and with seasons of the year. Hence, it must be related to the daily per capita consumption, which obviously is greater in hot climates than in cold climates and in hot weather of the same climate.

Another significant fact about fluoridation is that the scientific evidence suggesting it was much more complete ten years ago than had been the scientific evidence for the majority of community health programs when they were started.

Take, for example, the history of tuberculosis control: during the last years of the nineteenth century and the beginning of this, voluntary groups banded together to fight the Great White Plague, then the leading cause of death in this country. Science had provided no specific remedies; there was some evidence that bed rest and good food were of value, and there was conclusive evidence that the disease was infectious. Hence, the isolation of patients as a method of reducing the volume of infection proved a useful step. Starting, therefore, with little more than a hope and a prayer, a widespread campaign of education was undertaken. Anti-spitting ordinances were enacted, sanatoriums were built, and visiting nurses were sent to the homes of patients to instruct them in preventing the spread of the disease. In spite of the lack of precise tools, the death rate began to decline. Fifteen years before specific remedies were available such as streptomycin, isoniazid, and para-aminosalicylic acid, Wade Hampton Frost concluded that the biological balance already had been tipped against survival of the tubercle bacillus.

Another example can be drawn from the history of syphilis control. Arsphenamine was discovered by Ehrlich in 1912. Its use in conjunction with mercury and later with bismuth had been demonstrated as a valuable weapon against this widespread disease. Not until 1930, however, had any scientific measurements been made of the relative value of one or another of the several types of treatment currently in vogue. Treatment was far less precise than the public health officer would wish, it was prolonged and painful, and many patients did not continue under medical care until they had received its maximum benefits. Nevertheless, a nationwide program of syphilis control was inaugurated in 1938. I was perhaps rash in predicting, six years earlier, that even with the then scientific knowledge, syphilis could be made a rare disease within a generation if we had the will and the determination to attack it. The problem was made simpler when John F. Mahoney in 1942 discovered the effectiveness of penicillin as a safe, rapid method of curing almost 100 per cent of the patients.

In the use of fluoridation, thanks to Trendley Dean and his associates, the correlation between the amount of fluorine in a water supply, the prevalence of mottled enamel when excessive, and the high prevalence of dental caries when fluorine was absent or present only in minimal amounts, gave us a solid foundation on which to proceed.

Later studies have shown the wide margin of safety between optimal and deleterious levels of fluorine, a much wider margin of safety than confronts physicians in using many currently popular remedies. This audience is familiar, I am sure, with the latest publication, *Fluoridation as a Public Health Measure*, issued last year by the American Association for the Advancement of Science, and the report of the United Kingdom Mission, Ministry of Health, Department of Health for Scotland, 1953, entitled *The Fluoridation of Domestic Water Supplies in North America as a Means*

of Controlling Dental Caries, as well as the summary of valuable scientific evidence assembled for the National Commission on Chronic Illness by Dr. Kenneth F. Maxcy.

It is enough to say that scientific evidence indicates overwhelmingly the safety to the population and the value to its health of fluoridation as a public health measure.

The most authoritative summary which has come my way of the results from the Grand Rapids fluoridation is contained in a report by Arnold, Dean and Knutson on the basis of six and a half years of experience. This showed a reduction of dental caries in the permanent teeth of Grand Rapids children ranging from 66.6 per cent among six year olds to 18.1 per cent in the 18 year old group. Comparable results were observed in caries of deciduous teeth. The improvement was demonstrated also by a large reduction in the number of missing permanent teeth.

In the neighboring city of Muskegon where the water remained "fluoride-free" (0.2 ppm F) until the last three months of the study, no similar reductions in dental caries could be detected.

Of particular interest was the comparison of caries rates in Grand Rapids with those in Aurora, Ill., where the water supply contains natural fluorides of similar concentration. Insofar as these experienced investigators were able to determine, the use of fluoridated water results in the same health benefits as does that of natural fluoride water. These conclusions have not been challenged.

Other false issues have been raised. They have been dealt with conclusively by at least three authoritative publications: *Fluoridation Facts,* American Dental Association, February 1953; *Report of National Academy of Science,* National Research Council, pub. 214, 1951; and statement of the Commission on Chronic Illness, *Fluoridation of Water Supplies,* March 18, 1954.

Those of us who have had a long experience in public health can cite few, if any, instances in which the profession involved has acted with such promptness and vigor in promoting the wide application of a sound public health procedure. From the beginning, the American Dental Association and its constituent state and local societies followed closely the mounting scientific evidence as to the relationship between fluorine and dental caries. You supported the first community demonstrations in Grand Rapids and in Newburgh, New York. You answered criticisms which had been advanced against the procedure from that proportion of every population which fears change more than it fears the dentist, by marshaling all available facts and adding more conclusive evidence as it became available.

The American Dental Association has been joined in its efforts by practically every scientific organization having competence in the field. These include some 12 national organizations in this country and nine in Canada.

The aggressive sponsorship of a public health measure is bearing fruit as is shown by the fact that in the one year period, August 1953-August 1954, the number of communities adding controlled amounts of fluorine to drinking water increased from 785 to 1,000. The population being served by fluoridated water increased from 15,303,967 to 17,938,722. The number now exceeds 20 million.

Pittsburgh has joined the parade. Even conservative Philadelphia—once the center of science and culture in the colonies—has followed Pittsburgh's leadership.

I ask my esteemed colleague, Dr. Joseph Molner, Health Commissioner of Detroit, why this city has lagged on fluoridation when it has led on many other public health frontiers?

We still await action in New York City and Los Angeles. Has each lost its leadership in public health?

That we still have a long way to go is shown by the fact that two thirds of the total population of the United States live in areas served by 16,750 public water supplies. In terms of population served by public water supplies, slightly more than 20 per cent are drinking water containing optimum amounts of fluoride.

It seems clear, however, that the dental profession need not fear technological unemployment even when all public water supplies contain the optimum amount of fluorine.

Even though, as a result, the amount of dental caries in that two thirds of the population served by public water supplies is reduced to a third of current rates, there still will be a substantial residue of dental caries in urban and in rural populations. Moreover, many other dental conditions—especially those affecting the soft tissues around the teeth—probably will not be influenced to any substantial extent by the reduction in caries. In fact, here is another field of research awaiting attack on a broader base and with greater vigor.

Also, it has been suggested that the changes which occur in the oral mucous membranes might be used as one of the sensitive tests of physiological aging. Better yardsticks are badly needed to measure physiological age, especially in relation to the ability to work. Many of us who have studied the current criteria for retirement recognize that chronological age is not in itself an adequate measure of the physical and mental capacity of the individual. Physiologists are seeking to develop simple and more accurate criteria which would have practical application to industry. I feel that our dental colleagues may be able to make a real contribution to this issue by basic research and a new appraisal of the status of the oral mucous membranes and periodontal tissues.

Since everyone agrees that there are far too few dentists in this country to care for the present dental needs of our population, I agree with my Pittsburgh colleague, Milton E. Nicholson, that "preventive and control methods are the only logical approaches to the problem since it will never be possible to keep pace with the present rate of dental caries."

In Grand Rapids you are, fortunately, well on your way toward the realization of that ideal, even though another five years must pass before the two thirds reduction of dental caries can be applied to the total attack rate of all children in your city. You will have made a great contribution to youth—a contribution which will have a cor tinuing and beneficial effect as they grow to old age.

I hope, however, that you and your sister organizations will continue to interest yourselves in the many research problems still confronting us. I have mentioned only two of them.

Along with many others who have observed the pioneer work in fluoridation with its universally good results, I hope that under the leadership of the dental profession both public health authorities and the medical profession of the country will continue to press for the broad extension of fluoridated water supplies. This has been proved simple, cheap, effective and completely safe.

The task ahead of us is to spread the use of this highly effective procedure to all public water supplies having a natural fluorine content of less than 1 ppm. Of great importance, as well, is the necessity of devising methods which will assure those persons living in rural areas without access to fluoridated public water supplies of comparable protection for the dental health of their children. While the topical application of fluoride solution is widely practiced, the evidence seems less clear that it is as effective in preventing dental caries as is the optimum level of fluorine in drinking water for children during the period of tooth formation.

It is the rule rather than the exception

that there is a longer or shorter time lag between the proof of scientific procedures of benefit to health and the utilization of these procedures for the general welfare. Against this background, the fluoridation of public water supplies has progressed at better than the usual rate. We can be gratified at what has been accomplished, but we have no reason for complacency. Time enough has passed. Demonstrations such as this in Grand Rapids and those in other cities leave no logical base for the skeptic. You may be sure there would be few of them if dental caries were a direct cause of death.

It has been said frequently of professional education that teaching without research is sterile. It seems possible that to men of conscience, with normal sensitivity to human misery, practice without research might be even less rewarding.

Frankly, I place my confidence in the probability of accelerated progress in fluoridation in the people themselves, once they understand the whole story. In my home town of Pittsburgh, where we achieved fluoridation only within the past year, I was impressed with the readiness of acceptance by townspeople, public officials and newspapers—largely because of excellent leadership and persistent persuasion from the members of the dental profession.

We have a saying in western Pennsylvania that Pittsburgh is just like any other city, only more so. With comparable leadership, with persuasion from all the health professions and with the continuing and deft use of all appropriate measures for health education, I am confident that shortly the dental profession of America will have won its first, and perhaps largest, public health battle.

Other and more difficult tasks confront all of us who strive to promote the public health. But this is another topic.

Applied Knowledge • In the process of learning there should be present, in some sense or other, a subordinate activity of application. In fact, the applications are part of the knowledge. For the very meaning of the things known is wrapped up in their relationships beyond themselves. Thus unapplied knowledge is knowledge shorn of its meaning. *Alfred North Whitehead, "Essays in Science and Philosophy," New York, Philosophical Library, 1947, p. 219.*

Studies on the development of tolerance to selected antibiotics by susceptible oral lactobacilli

Samuel Dreizen, D.D.S.; Janet J. Mosny, B.S.; Ellie Jo Gilley, B.A., and Tom D. Spies, M.D., Chicago

In 1946 McClure and Hewitt[1] reported that rats which had been fed a cariogenic diet failed to develop dental caries when minute amounts of penicillin were added to their food and drinking water. The salivary lactobacillus counts were significantly reduced in the rats so treated. Two years later, Hill[2] showed that lactobacilli isolated from human saliva were either partially or completely inhibited in an agar medium containing 2.5 units of penicillin. Despite these laboratory findings, observations of the human caries-prevention potential of dentifrices containing penicillin have been contradictory.[3-6]

In those studies in which lactobacillus counts were done, no significant differences were observed between groups using control dentifrices and dentifrices containing from 100 to 1,000 units of penicillin per Gm. of powder.[7, 8] Also inconsistent are the observations regarding the role of penicillin in the prevention of acid production in the dentobacterial plaque.[9, 10] The question has been raised as to whether this seeming paradox could be reconciled on the basis of variability in response of oral lactobacilli to penicillin and other antibiotics. In accordance with this hypothesis, studies have been made of (1) the frequency of resistance among oral lactobacilli to a relatively high concentration of penicillin, and (2) the ability of susceptible oral lactobacilli to develop a tolerance to penicillin and to erythromycin, oxytetracycline, chlortetracycline, streptomycin and dihydrostreptomycin—antibiotics which have a microbial spectrum similar to penicillin or which prevent acid production in saliva

This study was supported by grants from the Clayton Foundation for Research.

From the department of nutrition and metabolism, Northwestern University Medical School.

1. McClure, F. J., and Hewitt, W. L. Relation of penicillin to induced rat dental caries and oral L. acidophilus. J. D. Res. 25:441 Dec. 1946.

2. Hill, T. J. Use of penicillin in dental caries control. J. D. Res. 27:259 April 1948.

3. Zander, H. A. Effect of penicillin dentifrice on caries incidence in school children. J.A.D.A. 40:569 May 1950.

4. Hill, T. J., and Kniesner, A. H. Penicillin dentifrice and dental caries experience in children. J. D. Res. 28:263 June 1949.

5. Hill, T. J.; Sims, J., and Newman, M. Effect of penicillin dentifrice on control of dental caries. J. D. Res. 32:448 Aug. 1953.

6. Walsh, J. P., and Smart, R. S. Clinical trial of a penicillin tooth powder. New Zealand D. J. 47:118 July 1951.

7. Fitzgerald, R. J.; Zander, H. A., and Jordan, H. V. Effects of penicillin dentifrice on oral lactobacilli. J.A.D.A. 41:62 July 1950.

8. White, B. J.; Kniesner, A. H., and Hill, T. J. Effect of small amounts of penicillin on oral bacterial flora. J. D. Res. 28:267 June 1949.

9. Fosdick, L. S.; Ludwick, W. E., and Schantz, C. W. Absorption of enzyme inhibitors and antibiotics in dental plaques J.A.D.A. 43:26 July 1951.

10. Brudevold, F., and Hawes, R. R. Effect of penicillin dentifrices on acid production in dental plaques and saliva. J. D. Res. 31:474 Aug. 1952.

in vitro when added in an amount of 5 mg. per 100 ml.[11]

MATERIALS AND METHODS

Two hundred and thirty-five cultures were made of lactobacilli which were recovered from the saliva of 450 patients of the Nutrition Clinic, Hillman Hospital, Birmingham, Ala. None of the patients were on antibiotic therapy. The organisms were isolated, grown in pure culture and identified generically by conventional bacteriologic methods. Their acid-producing capacity was assayed in double strength Landy and Dicken medium.[12] Resistance to penicillin was determined in duplicate tubes of 10 ml. yeast extract-dextrose broth containing 500 micrograms of penicillin G potassium. The inocula consisted of one drop of a physiological saline suspension prepared from a 24 hour thioglycollate broth culture in the manner described in detail in a previous publication.[13] The tubes were incubated at 37° C. for 72 hours. Growth was determined turbidimetrically; acid production by titration with 0.1 normal sodium hydroxide to the pH of uninoculated control tubes.

Ten organisms that were susceptible on first exposure to the inhibitory action of 500 micrograms of penicillin G potassium per 10 ml. were arbitrarily selected to determine the frequency and degree with which oral lactobacilli may develop tolerance to antibiotics. As a preliminary, the minimum inhibitory level of each of the test antibiotics for each of the ten organisms was determined. Thioglycollote-dextrose broth was used for penicillin, erythromycin, oxytetracycline and chlortetracycline; yeast extract-dextrose broth for streytomycin and dihydrostreptomycin. This modification was necessitated by the inactivating effect of thioglycollate on streptomycin and dihydrostreptomycin.[14] Each organism for which an inhibitory level could be established was then inoculated into duplicate tubes of thioglycollate-dextrose broth containing 1 microgram antibiotic per 10 ml. of medium. If growth was observed in 24, 48 or 72 hours, transfers were made into duplicate tubes containing the identical amount of antibiotic and into two tubes containing the next higher level. The gradations are shown in the illustration. This stepwise procedure was continued until either an inhibitory level was reached or until growth was attained at a concentration of 10,000 micrograms of antibiotic per 10 ml. of medium.

OBSERVATIONS

Of the 235 cultures of oral lactobacilli screened for their ability to withstand the inhibitory action of a relatively high concentration of penicillin, only 11 (4.7 per cent) grew in the presence of 500 micrograms of penicillin G potassium per 10 ml. of broth on first exposure. All others were completely inhibited at this level. Acid production in double strength Landy and Dicken medium by the organisms susceptible to the screening concentration of penicillin ranged from 1.2 to 17.7 ml. 0.1 normal acid compared to a range of from 1.9 to 14.9 ml. for the nonsusceptible forms. The respective means were 9.4 and 6.2 ml. 0.1 normal acid; the standard deviations, 3:53 and 3.59. Since one milligram of penicillin G potassium is equivalent to 1,595 units of penicillin,[15] the screening concentration was equivalent to 797.5 units of penicillin.

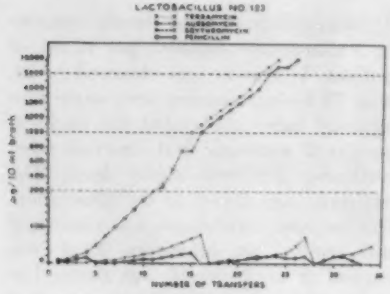
11. Fosdick, L. S., and others. New approach to problem of dental caries control. J. D. Res. 32:486 Aug. 1953.

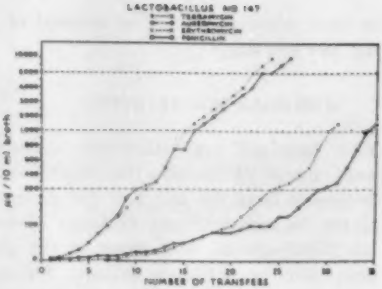
12. Landy, M., and Dicken, D. M. Microbiological assay method for six B vitamins using lactobacillus casei and a medium of essentially known composition. J. Lab. & Clin. Med. 27:1086 May 1942.

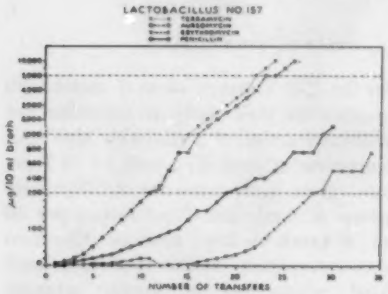
13. Dreizen, S., and Spies, T. D. Some observations on association of the products of protein putrefaction with dental caries activity. J. D. Res. 26:409 Dec. 1947.

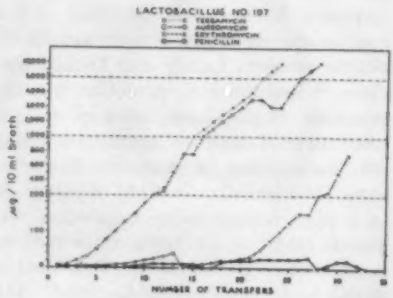
14. Krantz, J. C., Jr., and Carr, C. J. Pharmacologic principles of medical practice, ed. 2. Baltimore, Williams & Wilkins Co., 1951, p. 182.

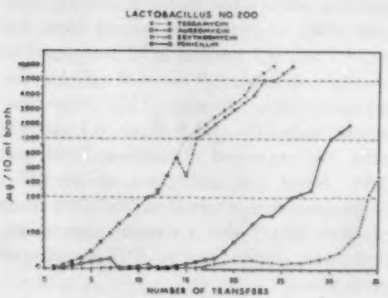
15. Pharmacopeia of the United States of America, fourteenth revision. Easton, Pa., Mack Printing Co., 1950.

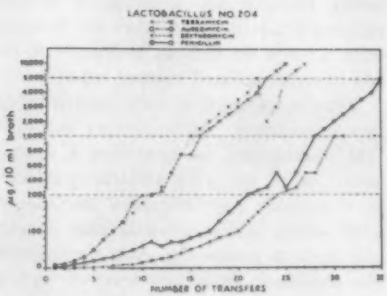

LACTOBACILLUS NO 183
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg/10 ml broth
NUMBER OF TRANSFERS

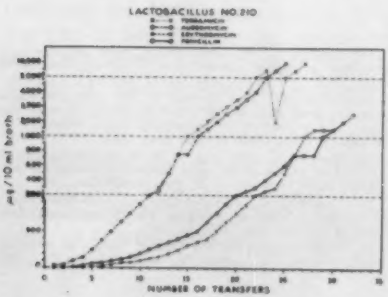

LACTOBACILLUS NO 187
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg / 10 ml broth
NUMBER OF TRANSFERS

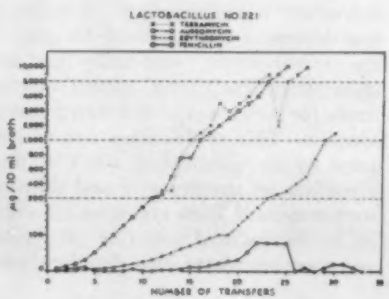

LACTOBACILLUS NO 197
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg/10 ml broth
NUMBER OF TRANSFERS

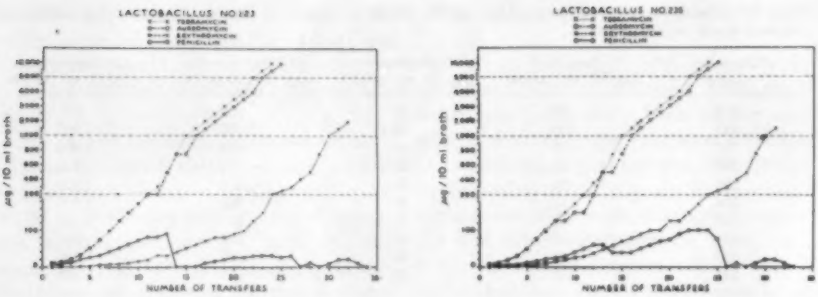

LACTOBACILLUS NO 197
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg / 10 ml broth
NUMBER OF TRANSFERS


LACTOBACILLUS NO 200
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg / 10 ml broth
NUMBER OF TRANSFERS


LACTOBACILLUS NO 204
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg / 10 ml broth
NUMBER OF TRANSFERS


LACTOBACILLUS NO 210
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg/10 ml broth
NUMBER OF TRANSFERS


LACTOBACILLUS NO 221
TERRAMYCIN
AUREOMYCIN
ERYTHROMYCIN
PENICILLIN
µg/10 ml broth
NUMBER OF TRANSFERS



Growth of oral lactobacilli in four different antibiotics of increasing concentration

The minimum amounts of each test antibiotic which completely prevented growth of the ten arbitrarily selected cultures of penicillin-susceptible lactobacilli are shown in Table 1. The values ranged from 50 micrograms for erythromycin, 50 to 150 micrograms for penicillin, 500 to 1,500 micrograms for oxytetracycline to 500 to 2,500 micrograms for chlortetracycline. None of the ten test cultures was inhibited by either streptomycin or dihydrostreptomycin at levels up to and including 10 mg. per 10 ml. of broth.

The frequency and degree of tolerance developed by the test organisms to oxytetracycline, chlortetracycline, erythromycin and penicillin are shown in Table 2. All ten oral lactobacilli attained the maximum experimental level of 10 mg. antibiotic per 10 ml. of medium in the presence of either oxytetracycline or chlortetracycline. This concentration was 4 to 20 times and 6.7 to 20 times greater than the minimum inhibitory levels of chlortetracycline and oxytetracycline on first exposure respectively. The organisms inoculated into broth containing chlortetracycline required 25 to 28 transfers to reach the upper experimental concentration, while those grown in broth containing oxytetracycline required 24 to 27 transfers. All test organisms grew at levels exceeding the minimum inhibitory concentration of erythromycin on first exposure by from 20 to 2,200 micrograms, values equivalent to a 1.4 to 50 times increase in tolerance. From 30 to 35 transfers were made. The maximum concentration which failed to inhibit the growth of a test organism in erythromycin was 2.5 mg. per 10 ml. of broth. Four of the ten test organisms failed to attain or exceed the minimum inhibitory level of penicillin G potassium effective on first exposure when cultured in subinhibitory concentrations of this agent. Six exceeded the minimum inhibitory level by amounts ranging from 40 to 4,950 micrograms, which was indicative of a 1.8 to 100-fold increase in tolerance. The organisms subjected to the action of penicillin were carried through 32 to 35 transfers. The maximum level tolerated by a test organism was 5.0 mg. per 10 ml. of broth, an amount equivalent to 7,975 units of penicillin.

The illustration shows the curves for each test organism grown in the presence of gradually increasing amounts of penicillin, erythromycin, chlortetracycline and oxytetracycline. In general, the curves for chlortetracycline and oxytetracycline were more obtuse and less erratic than those for penicillin and erythromycin. Whereas all test organisms showed similar curves for chlortetracycline and oxytetracycline, those for penicillin and erythromycin were characterized by a high

Table 1 • Minimum levels of antibiotics* completely inhibiting growth of 10 penicillin-susceptible cultures of oral lactobacilli on first exposure

Organism number	Penicillin (μg/10 ml. broth)	Erythromycin (μg/10 ml. broth)	Chlortetracycline (μg/10 ml. broth)	Oxytetracycline (μg/10 ml. broth)
123	50	50	500	500
147	100	50	2,500	1,500
157	100	50	1,000	1,500
197	50	50	500	500
200	50	50	2,500	1,500
204	50	50	1,500	1,500
210	50	50	2,500	1,500
221	150	50	500	500
223	50	50	500	500
235	150	50	500	500

*Neither streptomycin nor dihydrostreptomycin prevented the growth of any of the test organisms at levels up to and including 10 mg. per 10 ml. of broth.

degree of variation. Thus, while one organism attained the same level in both penicillin and erythromycin, six reached higher concentrations of erythromycin than penicillin and three reached higher concentrations of penicillin than erythromycin.

DISCUSSION

The failure to obtain a consistent reduction in lactobacillus counts along with a decrease in new carious lesions in subjects using dentifrices containing penicillin suggests that the lactobacilli isolated from the saliva of such patients could be either transient forms or resident forms which have developed a tolerance to the antibiotic. This study, which has been concerned only with the latter aspect, shows that approximately 5 per cent of oral lactobacilli are invulnerable to a relatively high concentration of penicillin on first exposure. In ten oral lactobacilli chosen at random that were sensitive to the screening concentration of penicillin, the minimum inhibitory concentration was 50 micrograms of penicillin G potassium (79.75 units penicillin) per 10 ml. of broth. It is questionable

Table 2 • Distribution and degree of increase in tolerance to penicillin, erythromycin, chlortetracycline and oxytetracycline by ten test cultures of susceptible oral lactobacilli*

Organism number	Penicillin		Erythromycin		Chlortetracycline		Oxytetracycline	
	Max. conc. tolerated (μg/10 ml.)	% increase in tolerance	Max. conc. tolerated (μg/10 ml.)	% increase in tolerance	Max. conc. tolerated (μg/10 ml.)	% increase in tolerance	Max. conc. tolerated (μg/10 ml.)	% increase in tolerance
123	30	—	70	40	10,000	1,900	10,000	1,900
147	1,500	1,400	1,500	2,900	10,000	300	10,000	567
157	1,500	1,400	750	1,400	10,000	900	10,000	567
197	30	—	750	1,400	10,000	1,900	10,000	1,900
200	2,000	3,900	500	900	10,000	300	10,000	567
204	5,000	9,900	1,000	1,900	10,000	567	10,000	567
210	2,000	3,900	1,500	2,900	10,000	300	10,000	567
221	75	—	1,500	2,900	10,000	1,900	10,000	1,900
223	90	80	2,500	4,900	10,000	1,900	10,000	1,900
235	100	—	1,500	2,900	10,000	1,900	10,000	1,900

*All test cultures attained the ability to withstand 10 mg. of either chlortetracycline or oxytetracycline per 10 ml. of broth, the highest concentration used in this study.

whether this concentration is reached in every dentobacterial plaque after the teeth have been brushed with the penicillin-containing dentifrices now available.

Six of the ten penicillin-sensitive oral lactobacilli tested developed the ability to withstand penicillin in amounts equal to 80 to 9,900 per cent over and above the minimum inhibitory level of this agent on first exposure. Thus, unless the initial quantity of penicillin reaching the dentobacterial plaque is sufficient to inhibit completely the growth of susceptible lactobacilli, many such organisms may develop a tolerance for penicillin. These observations apply to an even greater degree to erythromycin, chlortetracycline, oxytetracycline, streptomycin and dihydrostreptomycin, the other antibiotics included in this investigation.

It would seem that if an antibiotic is to be used successfully as a caries preventing agent, it is essential that it always reach the dentobacterial plaque in a concentration sufficient to inhibit the growth of all microorganisms implicated in the caries process.

SUMMARY AND CONCLUSIONS

1. Oral lactobacilli differ greatly in their sensitivity to different antibiotics. When compared on a basis of per unit weight, erythromycin was most effective as an inhibitor of oral lactobacilli followed in decreasing order by penicillin, oxytetracycline and chlortetracycline. Streptomycin and dihydrostreptomycin were ineffective in the concentrations used.

2. Oral lactobacilli differ greatly in their sensitivity to different concentrations of the same antibiotic. In a survey of 235 previously unexposed cultures of oral lactobacilli, the minimum inhibitory levels of penicillin G potassium ranged from 50 micrograms to over 500 micrograms per 10 ml. broth.

3. Oral lactobacilli can develop a tolerance to inhibitory concentrations of penicillin, erythromycin, oxytetracyline and chlortetracycline when exposed repeatedly to subinhibitory levels of these antibiotics. This occurs less frequently in the presence of penicillin than in the presence of erythromycin, chlortetracycline and oxytetracycline.

Circulating Science • Scientific journals are the circulatory system for the ideas of science. It is largely through them that science develops, for scientific growth is the result of cross-fertilization between laboratories and groups of different countries. One of the evil consequences of war is that it stops the flow of scientific ideas from one nation to another. And to the extent that this process is blocked the development of science is definitely retarded. *Raymond B. Fosdick*

Cases and Comments

ACRYLIC RESIN VENEER CROWN WITHOUT PERIPHERAL UNDERCUTS

By A. H. Tamarin, D.D.S., Chicago.

The acrylic resin veneer crown without peripheral undercuts has the following advantages: it can be adapted to almost any tooth; by its use esthetics are improved; it is easily constructed. This crown can be fabricated by the following method.

The tooth is prepared for a crown and for taking a tube impression. A stone or plaster model of the prepared tooth is then made. A wax bite and plaster impression of the involved tooth and the adjacent teeth are used to make casts. The stone model with the involved tooth in position serves for articulation. The next steps are illustrated in this report.

Fig. 1 • The stone model of the tooth is saturated in a dish of water and the surplus water removed. The prepared portion of the model is dipped in a dish of molten inlay wax and withdrawn instantly. The uniform and well adapted wax coping thus obtained will not adhere to the stone model. The surplus wax is removed easily from the model with the point of a sharp knife by cutting around the gingival outline. This procedure isolates the wax coping. Any thickness of coping can be obtained merely by repeating the process described.

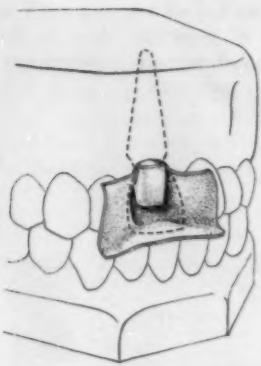


Fig. 2 • The wax coping on the stone model is mounted into position on the articulator. A small rectangular sheet of Kerr's green sheet wax, gauge 30, is placed lingually to the wax coping with the two sides extending labially around the mesial and distal surfaces of the coping.

Fig. 3 • A hot spatula is used to unite the wax sheet with the wax coping in the region of the cingulum. The sides of the sheet wax are cut off to the labial surfaces of the adjacent teeth. The wings are molded to the anatomic shape of the lingual aspect of the involved tooth.

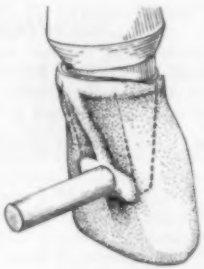


Fig. 4 • A hot spatula is used to unite the wax sheet to the coping on the lingual surface. This union is in the form of an inverted "T." The transverse line of the "T" coincides with the incisal edge of the coping; the longitudinal line of the "T" runs parallel to the longitudinal axis of the tooth. The entire gingival edge of the two surfaces are united also. A sprue 2 mm. in diameter is attached to the lingual-incisal juncture at the center of the transverse line of the "T," where the incisal edge of the coping unites with the outer sheet. The wax pattern is now ready for casting with a hard casting gold.

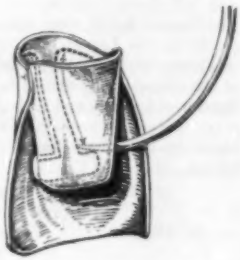


Fig. 5 • The "T" union of the outer sheet and the coping forms two pockets. These pockets extend from the "T" union on the lingual surface to the mesial and distal surfaces of the coping. In this illustration, a hook explores the extent of the left pocket. It is into these pockets that the acrylic resin penetrates, gripping the coping.

Fig. 6 • The acrylic resin which is packed into the pockets plus the resin on the labial surface form a cylinder which incases the coping. This cylinder is supported by the lingual surface of the outer metallic sheet as well as by the curvature of its mesial and labial borders. The cylinder of acrylic resin is illustrated here as it would appear without its gold frame.

Fig. 7 • The crown is now completed.

Conclusions • The encasement of the acrylic resin wings by the outer metallic sheet, together with the curvature of the acrylic resin, forms an anchorage. Since this type of anchorage does not depend on peripheral undercuts, the mesial and distal walls as well as the wall on the incisal edge of the outer frame can be reduced to a minimum. The anterior gingival aspect is completely void of any undercuts, and the acrylic resin covers the entire coping. This procedure keeps the gold frame from being seen and thereby improves esthetics.

25 E. Washington Street

BUREAU OF LIBRARY AND INDEXING SERVICE

Additions to the Library

The books listed here have been added recently to the Library collection. Requests for this material, available on loan to all members of the Association, should be addressed to the Bureau of Library and Indexing Service. There is no charge for borrowing books. Most of the books may be purchased also through the Library.

BOOKS

AIX-MARSEILLE UNIVERSITY. Jubilé du Professeur G. Beltrami; cérémonies officielles, compendium des travaux scientifiques. Marseille, Cahiers Odonto-stomatologiques, 1953. 94 p.

AMERICAN DENTAL ASSOCIATION. BUREAU OF DENTAL HEALTH EDUCATION. Planning dental health conferences. Chicago, The Association, 1955. 29 p.

AMERICAN DENTAL ASSOCIATION. BUREAU OF ECONOMIC RESEARCH AND STATISTICS. Distribution of dentists in the United States by state, region, district and county. Chicago, The Association, 1955. 62 p.

AMERICAN DENTAL ASSOCIATION. BUREAU OF ECONOMIC RESEARCH AND STATISTICS. Facts about states for the dentist seeking a location. Chicago, The Association, 1955. 35 p.

AMERICAN DENTAL TRADE ASSOCIATION. 1955 survey of senior dental students. Washington, The Association, 1955. 36 p.

ANDERSON, G. M. Practical orthodontics. St. Louis, Mosby, 1955. $17.50.

ASOCIACION ODONTOLOGICA ARGENTINA. Indice de la literatura dental periodica en Castellano y Portugues 1952. Buenos Aires, The Association, 1952. 88 p.

BERGER, ULRICH. Sterilisation, Desinfektion und Hygiene in der zahnärztlichen Praxis. Munich, Urban & Schwarzenberg, 1954. 78 p. $2.50.

BESOMBES. Hygiène et soins bucco-dentaires durant la période pré-scholaire. Paris, Comité National d'Hygiène Bucco-Dentaire, 1952. 67 p.

BOERS, HEDDA. Folketro om taender, tandmidler og tandbehandling hos almuen i Danmark et studium i dansk folkemedicin. Copenhagen, Dansk Videnskabs Forlag, 1954. 183 p.

BOX, H. K. Oxygen insufflation in periodontal disease. Springfield, Thomas, 1955. 94 p. $3.50.

BRAUER, J. C., ed. The dental assistant. New York, McGraw-Hill, 1955. 398 p. $7.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS. Transactions, 1953. London, The Society, n.d. 190 p.

CHEESEMAN, J. E. Baillière's synthetic anatomy. pt. IX: Head and neck. pt. IXa: The pterygo-maxillary region. London, Baillière, n. d. 18 p. $1.50.

CLARK, H. B. Practical oral surgery. Philadelphia, Lea & Febiger, 1955. 392 p. $8.50.

CONFERENCE ON CONNECTIVE TISSUES. Connective tissues; transactions of the Fifth Conference February 8, 9, and 10, 1954. Princeton, N. J., ed. by Charles Ragan. New York, Macy, 1954. $3.75.

DILLING, W. P. & HALLAM, SAMUEL. Dental materia medica, pharmacology and therapeutics. 4th ed. London, Cassell, 1954. 406 p. $3.60.

EICHENBERGER, FRITZ. Über die Anwendung des Lachgases in der konservierenden Zahnheilkunde. (Odontologica fasc. 3) Basel, Benno Schwabe, 1952. 43 p.

ERAUSQUIN, JORGE. Histologia dentaria humana. Buenos Aires, Progental, 1953. 281 p.

FASTLICH, SAMUEL. Bibliographia odontologica Mexicana. Mexico, La Prensa Medica Mexicana, 1954. 220 p.

GISLER, KARL. Über Dentinimprägnation. (Odontologica fasc. 2) Basel, Benno Schwabe, 1952. 39 p.

HALS, EINAR. Fluorescence microscopy of developing teeth. Oslo, Norwegian Academic Press, 1953. (Reprinted from Odontologisk Tidskrift, Vol. 61) 130 p. $3.15.

HARWOOD, E. C. How to invest wisely. Great Barrington, Mass. American Institute for Economic Research, 1955. 112 p. $1.

HOTZ, R. Orthodontie in der täglichen Praxis. Bern, Hans Huber, 1954. 314 p. $11.50.

HUSSAR, A. E. & HOLLEY, H. L. Antibiotics and antibiotic therapy. New York, Macmillan, 1954. 475 p. $6.

JAMES, M. D. The dentist. Toronto, Dent, 1955. 32 p. $1.

JENSEN, J. R. A clinical manual of endodontia. Dubuque, Iowa, Brown, 1954. 81 p. $3.

KAHN, SAMUEL. Make inferiorities and superiorities work for you. Ossining, N. Y., Dynamic Psychological Press, 1954. 184 p.

KEMPF, FRITZ. Beitrag zur indirekten Pulpaüberkappung mit Sero-Calcium. (Odontologica fasc. 4) Basel, Benno Schwabe, 1953. 16 p.

KING, J. D.; MELLANBY, MAY; STONES, H. H.; GREEN, H. N. The effect of sugar supplements on dental caries in children. (Medical Research Council special report series no. 288) London, H. M. Stationery Office, 1955. 55 p.

KOCH, REINHARD. Die Einwirkung von Nelkenöl (Oleum caryophylli) und Eugenol auf die Pulpa. (Odontologica fasc. 5) Basel, Benno Schwabe, 1953. 20 p.

MARI, T. M. Ceramica dental. v. 1: Las coronas-funda en la rehabilitacion morfofisiologica, psiquica y estetica. Buenos Aires, Editorial Mundi, 1954. 96 p.

MILLIS, H. A. & MONTGOMERY, R. E. Economics of labor. v. 1: Labor's progress and some basic problems. v. 2: Labor's risks and social insurance. v. 3: Organized labor. New York, McGraw-Hill, 1938-45.

OCTAVO SEMINARIO ANUAL DEL GRUPO DE ESTUDIOS DENTALES U. S. C. DE MEXICO. Tehuacan, Pue., Mexico, May, 1955. 145 p.

PALAZZI, SILVIO. Die Paradentopathien. Basel, Benno Schwabe, 1953. 188 p.

PEER, L. A. Transplantation of tissues. v. 1: Cartilage, bone, fascia, tendon, and muscle. Baltimore, Williams & Wilkins, 1955. $13.50.

PETZOLD, ROLAND. Über Herkunft und Bedeutung der Speichelkörperchen. (Odontologica fasc. 1) Basel, Benno Schwabe, 1952. 35 p.

SAMSON, EDWARD. Progressive practice in dentistry. 3d ed. London, Technical Press, 1955. 328 p. $4.00.

SPRENG, MAX. Der Kauabdruck; praktische Grundlagen der zahnärztlichen Prothetik. Munich, Urban & Schwarzenberg, 1953. 243 p.

THIBAULT, R. & PARANT, M. Petite chirurgie de la bouche. 4th ed. Paris, Expansion Scientifique Française, 1954. 189 p.

THOMA, K. H. & ROBINSON, H. B. G. Oral and dental diagnosis. 4th ed. Philadelphia, Saunders, 1955. 449 p. $10.50.

WARREN, R. L. Studying your community. New York, Russell Sage, 1955. 385 p. $3.

WEINER, J. S. The Piltdown forgery. London, Oxford, 1955. 214 p. $3.50.

WEINMANN, J. P. & SICHER, HARRY. Bone and bones; fundamentals of bone biology. 2d ed. St. Louis, Mosby, 1955. 508 p. $13.50.

The American Dental Association Film Library

The films reviewed in this article are available from the Film Library at a nominal rental fee of $2.50 to dental societies, study clubs, dental schools, hospital dental staffs, and armed services dental personnel. Since the number of prints of each title is necessarily limited, it is suggested that program chairmen plan their programs far enough in advance to insure availability.

Both of the films discussed will appear on the annual session motion picture program in San Francisco. The film, "Local Anesthesia in Dentistry, (Part II, Maxillary Considerations)" will be shown Tuesday, October 18 at 12:25 P.M. and again on Wednesday, October 19 at 4:25 P.M. This is a sequel to the first in the series by the same producers, "Local Anesthesia in Dentistry, (Part I, Mandibu-

lar Considerations)." The second film reviewed, "The Pterygopalatine Injection for Blocking the Maxillary Nerve," will be shown on Tuesday, October 18 at 1:30 P.M.

FILM REVIEWS

Local Anesthesia in Dentistry (Part II, Maxillary Considerations). 16 mm., sound, 1,200 ft., 30 minutes. Produced in 1954 by Niels B. Jorgensen, D.D.S., and John E. Hughes, M.D., Medical College of Evangelists, Loma Linda, Calif. Photography by Ed Hamilton. Medical artist, Zolton Yuhasz. Animation by Royal Titles and narration by Julius Holbrook, M.D. Production assisted by a grant from Cook-Waite Laboratories, Inc., New York. Rental fee, $2.50, and procurable from the American Dental Association Film Library, 222 E. Superior St., Chicago. The film can be purchased from the producers for $188.37, including reel and can.

Accepted nerve blocks and infiltration anesthesia are demonstrated on skulls on which important landmarks are designated; also through dissections to show the relations of vessels and muscles, and finally on patients. The film opens with an explanation and a demonstration of supraperiosteal infiltration. The following are demonstrated in sequence: infraorbital block, zygomatic block, nasopalatine block and anterior palatine block. The film concludes with a review of the various types of injections and how some may be used to supplement others. Contraindications are noted throughout. The film is well organized and well photographed. The use of the various aids, such as skulls, specimens, diagrams and patients, increases its instructional value. Since the sequences on anatomy are excellent, the film may be used in a course on anatomy in the dental school as well as in a course on anesthesia. General practitioners may find it informational. It is suitable for use by all dental professional groups.

The Pterygopalatine Injection for Blocking the Maxillary Nerve • 16 mm., color, silent, 400 ft., 15 minutes. Produced in 1954 by Joseph E. Grodjesk, D.D.S., and Leonard Szerlip, D.D.S., Jersey City. Rental fee, $2.50 from the American Dental Association Film Library, 222 E. Superior St., Chicago. Purchase arrangements can be made through Dr. Joseph E. Grodjesk, 650 Bergen Ave., Jersey City.

The film opens by showing the case records in a dental office. This sequence introduces the film title and credits. Throughout the film all of the legends are on index cards.

The technic for obtaining complete anesthesia of the maxilla by a single injection is shown in detail through anatomical drawings and on dry specimens. In addition, the technic is demonstrated on two patients. The type of syringe used and the angles at which it is held are pictured. Methods to determine when anesthesia is complete are discussed and indications and contraindications for use of the technic are demonstrated.

The film is well organized but the technical production could have been improved. The legends would be more legible if the type were larger and the background a solid color. The continuity is good.

This film is suitable for teaching and for study clubs. Dental societies may find it interesting program material. Dental practitioners will find it informational.

SEPTEMBER 1955

LON W. MORREY, D.D.S., EDITOR
VOLUME 51 • NUMBER 3
Published by the American Dental Association
222 E. Superior Street • Chicago 11, Illinois

THE Journal OF THE AMERICAN DENTAL ASSOCIATION

Editorials

Recent reports cast new lights and new shadows on etiology of dental decay

The effect of sugars and other carbohydrates on the teeth remains one of the foremost dental problems under discussion by the profession. Members who missed the symposium on this subject at the Miami session of the Association will find the four symposium papers published in this issue[1] particularly interesting.

Each report deals exhaustively with a specific phase of the caries problem, and collectively they make a solid contribution to the growing volume of literature dealing with the subject. Although each essayist points out that much remains unknown regarding the complexities involved in the destruction of tooth structure by carious action, they agree that the presence of carbohydrates—especially sugars—on the teeth is an essential in the production of dental decay—a thesis with which few dental researchers today will disagree. In fact, the causal relationship of sugar ingestion to tooth decay is supported by so much evidence that reports of studies indicating the contrary are viewed with considerable skepticism.

One such report recently arrived from overseas. Prepared by the dental research committee of the Medical Research Council of Great Britain, it is entitled "The Effect of Sugar Supplements on Dental Caries in Children."[2] It concerns a two-year study of 2 to 14 year old institutionalized children living in three widely separated areas in England. Despite the excellent reputation enjoyed by the ten members of the dental research committee, it is highly unlikely that other researchers—except possibly those associated with the sugar industry—will accept the report without question.

The Medical Research Council's case for the safety of sugar is based on data resulting from two years' observation of the three groups of children. Each group was divided into control and test subgroups; children in the test groups received an additional allowance of sugar. The London group of institutionalized children ranged in age from 2 to 4 years; those in the control group received 11 ounces of sugar per week whereas those in the test group received twice that amount. In the other two institutions housing children from 4 to 14 years of age, the children in the control group received the regulation amount of sugar supplied by the home, whereas the children in the test group were given an additional 22 ounces per week.

The London study particularly suffered from unavoidable losses in children leaving the study. Apparently, 678 children, aged 2 to 5 years, were examined at the beginning of the study in 1949; 391 at the end of the first year; 224 at the end of a year and a half; and 82 at the end of the second year. The 82 were divided into 30 from the control group, 32 from the group using white sugar and 20 from the group using brown sugar. It is doubtful if inferences are warranted from such small samples, particularly in view of the numerous variables which must have existed among 21 different small centers located in and within a 60 mile radius of London. The authors state (p. 15), "Each home made its own arrangements for giving chocolates and sweets to the children. Sometimes they were given as part of a meal, sometimes immediately after, and sometimes between meals or even at bedtime."

Nevertheless, at the conclusion of the study the investigators reported:

> The results of the investigation are, in the main, clear-cut and therefore can be stated quite briefly. They demonstrate that relatively great differences in the total sugar content of the diets of children in institutions had no significant effect on the initiation or spread of dental caries in periods of 1 to 2 years.

It will be interesting to see how soon the sugar industry will make capital of these observations which are in direct contrast to those of Jay, Becks, the Vipeholm study and many other investigations.

It will be interesting also to read the reactions of other dental researchers to the Council's caries report. Already it has been pointed out that in parts the design of the experiment is faulty and the evidence adduced fails to support the sweeping conclusion reached. The study in no way invalidates the numerous studies showing a dental caries-sugar relationship.

It is unlikely that the caries report of the Medical Research Council will be accepted by the profession with the promptitude accorded the caries symposium papers published in this issue. Nevertheless, both reports deserve careful study even though one appears to be out of harmony with accepted facts. Members of the profession should maintain an open and fair-minded attitude toward new reports and new observations. They should, however, critically analyze new data in the light of scientifically proved facts. In this way it will be possible to obtain a clearer picture of the mechanisms which give rise to dental lesions.

1. Pages 269 to 306 of this issue.

2. King, J. D.; Mellanby, May; Stones, H. H., and Green, H. N. The effect of sugar supplements on dental caries in children. London, Her Majesty's Stationery Office, 1955.

Father Knickerbocker tips his hat to Father Dearborn

For several months past there has been considerable speculation among a number of researchers as to which of two cities—New York or Chicago—would be the first to approve the fluoridation of its water supplies. The announcement July 18 that Chicago's Mayor Daley had ordered the installation of equipment for that purpose settles the debate in favor of the Midwestern metropolis. For once the brawling, sprawling product of the prairies has outdistanced her older and larger and more erudite neighbor.

Chicago's decision was not reached without rancor. Old and close friendships in the health committee of the City Council broke over the issue. Months of stormy Council sessions ended in name calling, delayed action, charges and countercharges—none of which were nice. One councilman—a proponent of fluoridation—met near defeat for re-election because of the heated opposition of the anti-fluoridation forces in his district. Gaining no ground in the Chicago City Council, the opponents of fluoridation forced a bill through the State Legislature which would have authorized a referendum on the measure. In vetoing the bill, William G. Stratton, Illinois governor, made what may become a historic observation: "A referendum cannot establish or destroy an established fact."

With the roadblocks removed both in the City Council and the State Legislature all that remains to be done to make the benefits of fluoridation available to the children of Chicago and 43 of the 51 suburbs supplied by that city's water system is to install the necessary equipment. (Eight of the involved suburbs have been fluoridating their water supply for some time.) Reports indicate that fluoridation of the city's billion gallon a day water supply will start late this fall at which time another four million or more people will begin to experience the dental health benefits now being enjoyed by more than twenty million people in approximately eleven hundred American communities.

The *New York Times*,[1] one of the nation's as well as one of that city's leading papers, editorially voices its chagrin at New York's being outdistanced by Chicago in this important health matter. Says the *Times*:

> We yield to Chicago in few matters worthy of civic pride, but the second largest city has now gone ahead of New York in one important public health measure. Its mayor has ordered contracts made for fluoridation of water supply, which will benefit not only Chicagoans but also fifty-one suburbs buying Lake Michigan water from Chicago.
>
> New York studies the question while others act. . . .
>
> The case for fluoridation has been proved for years and no case against it has been made anywhere that convinces any of the top medical or dental organizations of the country.

It is hoped that Father Dearborn's decision to provide his family with this latest health protection will stimulate Father Knickerbocker to "go and do likewise"—and do so soon.

1. Editorial, New York falls behind, New York Times, August 1, 1955.

Just what the dentist ordered

Readers will be interested to learn of the unusually gratifying response to the Association's June 1 formal invitation to subscribe to DENTAL ABSTRACTS. Though the first issue of the publication is not to appear until January 1956, by August 1 more than 4,100 persons had become prepaid charter subscribers. All the 48 states are represented in the charter subscription list, as are many countries abroad, among them Austria, Australia, Brazil, British West Indies, Canada, Colombia, Cuba, Dominican Republic, Egypt, England, Finland, France, Germany, Israel, Mexico, Morocco, Norway, Panama, Peru, Siam, South Africa, Sweden and Switzerland.

Subscriptions have come from practicing dentists, editors, research men, students, teachers, technicians, local and state departments of public health, libraries, hospitals, foundations, universities, laboratories and manufacturers of dental equipment. From this splendid initial response it is deduced that DENTAL ABSTRACTS will meet a long-felt need.

Plans provide that the editorial staff will select and abstract approximately one hundred of the more informative articles appearing each month in the world's dental and allied scientific literature. This procedure will enable subscribers to maintain more than a passing knowledge of dental progress as reported in dental literature and in the literature of such related fields as anesthesiology, bacteriology, roentgenography, metallurgy, chemistry, plastics, physics, engineering, crystallography, mineralogy, biology, enzymology and public health.

Although each abstract will be complete in itself and will give the reader the gist of the original paper, it will not and cannot be as valuable as the original, to which the interested reader will have to refer for the complete text, the illustrations, charts, tables and bibliography. One of the principal values of DENTAL ABSTRACTS is that it will encourage wider reading of dental publications, as each issue will whet the reading appetite of the subscriber and prompt him to refer to many substantial and interesting articles which normally would not come within the scope of his reading.

There is still time to become a charter subscriber at the modest cost of $6.00 a year for U. S. readers (abroad, $7.00). Turn to page A-35 of this issue for a subscription blank.

Washington News Letter

The Armed Forces, with the Navy as the spearhead, have embarked on a career incentive program which they hope will make unnecessary another extension of the doctor-draft law in 1957. The Department of Defense has disclosed details of the "Grenfell package plan," most parts of which can be instituted by the services themselves. For the remainder, Congressional action will be requested early next year. The over-all objective is to stimulate voluntary procurement for the Medical and Dental Corps by providing inducements of increased pay, bonuses for extended service, higher entering rank, subsidies to junior and senior students in exchange for obligated military service after graduation, various professional advantages and others.

Development of this incentive "package" was by a special Department of Defense task force headed by Rear Admiral E. W. Grenfell, a line officer. The Army, Navy and Air Force medical departments had representatives on the group. Its creation resulted from a letter written last March by Rear Admiral Bartholomew W. Hogan only a few weeks after he took office as Surgeon General of the Navy.

NAVY URGED INCENTIVES

With its years of tradition as a voluntary service, the Navy has taken drafted enlisted men—and, later, dentists and physicians—only with great reluctance. Even last spring, when it became evident that another two year extension of the doctor-draft law would be necessary, Admiral Hogan's position was that incentives for voluntary recruitment would be more effective and less costly to the government than the compulsory method.

The Navy Surgeon General wrote to Secretary of the Navy Charles S. Thomas, citing the alarmingly high number of resignations from the Regular Dental and Medical Corps and recommending higher income provisions as the most satisfactory solution. With Vice Admiral James L. Holloway, chief of naval personnel, supporting Admiral Hogan's arguments, appointment of the Grenfell committee followed and now its study and conclusions have been disclosed.

The services themselves already possess authority to effectuate such recommendations as the following: assurance of optional retirement after 20 years; increasing constructive service credit so that entering rank for physicians and dentists would be captain and lieutenant; revision of promotion policy; improvement of duty assignments; educational subsidies, and encouragement of attendance at professional meetings.

It is up to the Secretary of Defense to act on recommendations to increase ratios of dentists and physicians. Congressional authority is required for upgrading of officers on the active list, adoption of bonuses for officers contracting to stay on active duty for extended periods and liberalization of longevity credit. A bill has been drafted along these lines and will be introduced in Congress next year.

Meantime, Selective Service headquarters has issued a bulletin ordering local draft boards to call up for re-examination certain dental registrants. Notices will be sent to all dentists in Priorities I, II and III, presently classified in 1-A and who have not been examined by their local boards since August 1, 1954. The only exceptions will be those dentists who have reached, or who will reach, their 46th birthday during the calendar year of 1955.

LEO SCHOENY RESIGNS

Leo J. Schoeny of New Orleans, a member of the Health Resources Advisory Committee since its inception, has resigned. At HRAC offices in the Office of Defense Mobilization, it was said he would remain until a successor is appointed. Dr. Schoeny also will relinquish the chairmanship of the Interagency Council for Dental Affairs, whose members are heads and top ranking members of military and civilian dental agencies in the federal government.

Arthur S. Flemming, director of Defense Mobilization, wrote Dr. Schoeny that he accepted his resignation "with deep regret" and added, "I deeply appreciate the splendid contribution you have made to the Nation's health."

HEALTH CARE FOR DEPENDENTS

Shortly before adjournment of Congress early in August, two bills were introduced on expansion of health care benefits for dependents of military personnel. One was the official Administration plan, drafted by the Department of Defense and approved by President Eisenhower. The other was drawn up by the American Hospital Association.

The Administration bill is predicated on 53 per cent of dependents being cared for under direct military auspices, with the remainder being accommodated under prepaid insurance or on a fee-for-service basis. Under the latter options, the government would pay 70 per cent of the cost. The other bill places emphasis on insurance coverage, with the government assuming full cost.

With respect to dental services, the Administration bill is the more liberal. Dental services would be made available to dependents outside the continental limits and "in remote areas within the continental limits of the United States where adequate civilian dental facilities are not available." Further, dental care could be provided in cases of emergency and as a necessary adjunct to medical or surgical treatment.

In the other bill, however, it is specified that dental care for dependents could be authorized only as a medical or surgical adjunct.

The House Ways and Means Committee recently published a 282 page transcript of its June hearings on the Keogh-Jenkins bills authorizing establishment of pension plans by self-employed professional people. The printed volume contains not only the text of testimony presented by spokesmen for the American Dental Association and other professional groups but also hundreds of telegrams and letters sent to the committee in support of this legislation.

Communications from some 30 state dental associations and scores of individual practitioners are included in the transcript.

Shortly before adjournment of Congress, the committee voted in favor of a modified pension plan, with introduction of the revised bill scheduled for next January.

International Correspondence

NEWS FROM GREAT BRITAIN

There is little doubt that the annual conference of the British Dental Association in Glasgow, Scotland, July 4-8, which marked the 75th anniversary of the Association, was one of the most successful ever held, writes W. Stewart Ross. The Scots are known the world over for their hospitality, generosity and unbounded enthusiasm for the job on hand, and the Glaswegians who staged this conference lived up to this reputation.

The new president, Dr. Husband, was installed at the beginning of the conference, and few men have earned this coveted honor more. He has held the office of chairman of the Council for 14 years, which in itself is a record, and has led the Association through perhaps the most difficult period of its existence. The amalgamation of the three independent dental associations under the banner of the British Dental Association was due in great measure to Dr. Husband's efforts, and he has steered the Association through the difficult and often exasperating periods of the National Health Service.

During the meeting the rare distinction of the Higher Dental Diploma of the Royal Faculty of Physicians and Surgeons of Glasgow was conferred on him and on Sir Wilfred Fish, chairman of the Dental Board.

Among the essayists was the indefatigable Dr. Nord from Amsterdam, Holland, honorary president of the Fédération Dentaire Internationale. His controversial subject, orthodontics, held a large audience for more than two hours, and his paper was undoubtedly one of the high lights of the Conference.

The demonstrations were of a high order and were attended by a record gathering of dentists from all over the British Isles.

HISTORICAL RECORDS

During the period of the annual conference of the British Dental Association, J. Menzies Campbell (honorary member, American Academy of the History of Dentistry) had many American items on display in the Hunterian Museum, by permission of the Glasgow University Court. They included: *Lectures on the Natural History and Management of the Teeth* (New York, 1821). By L. S. Parmly, a member of a notable family of American dentists. He has justly been termed "the apostle of dental hygiene." Manuscript of *A Treatise on the Structure, Diseases and Management of the Human Teeth* (published in Utica, 1824), with *Congress Certificate* protecting the title. By Eleazer Gidney, a skillful, widely traveled dentist, who practiced first in Utica, later in New York, and for many years in Manchester, England. *Eleazer Gidney's removal notices* (1837), with various commendations, and his *Certificate of Election* (signed by Chapin A. Harris) to honorary membership of the *American Society of Dental Surgeons* at its first meeting, 1840.

Also on display were: *The Family Dentist* (Boston, 1824). By Josiah Flagg, the versatile son of a pioneer Boston dentist. *The Art of Preserving Teeth* (Salem, 1824). By Nathaniel Peabody, Fellow of the Massachusetts Medical Society. *A System of Dental Surgery* (New York, 1829). By Samuel S. Fitch of Philadelphia. The first dental textbook for students to be published in America. *Guide to Sound Teeth* (New York, 1836). By Shearjashub Spooner, who was also a man of letters and an art collector. *Observations and Diseases of the Teeth* (New York, 1838). By Harvey and John Burdell, who condemned charlatanism and advanced a plea for specialization. *An Essay on Teeth* (Hartford, 1838). By Horace Wells who, in December 1844, discovered the anesthetic properties of nitrous oxide. *The Dental Art* (Baltimore, 1839). By Chapin A. Harris who, in 1839, founded the first dental journal and, in 1840, the Baltimore College of Dental Surgery. This book was the first original work to be published in America, written exclusively for the dental profession.

The collection contains: *Dentologia: A Poem on the Diseases of the Teeth* (New York, 1840). By Solyman Brown, who can justifiably be described as poet laureate of the dental profession. *The New York Dental Recorder* Nos. 1-12 (1846-47). Edited by J. S. Ware. It ceased publication in November 1856. *A Practical Treatise on the Operations of Surgical and Mechanical Dentistry* (Philadelphia, 1847). By Samuel C. Harbert, who condemned the practice pursued by some dentists of fitting artificial dentures over unhealthy roots. *Hints for the Multitude Relative to the Teeth* (Hartford, 1848). By Hiram Preston, who stated, "If we must be cheated at all, it is

much better that we pay too much for good work than that we pay the smallest conceivable sum for that which is worse than useless." *An Address* (Baltimore, 1849). By J. H. Foster, excerpts from whose peroration are ". . . Your standard should be planted high above you where you can behold it . . . Let your aim be to climb the mountain but never expect to reach the highest pinnacle. Perfection is not for mortals . . . Strive with your contemporaries in all honorable endeavors to see who shall approach nearest to it." *The Tooth-Ache, Imagined by Horace Mayhew and Realized by George Cruikshank* (Philadelphia, 1849). Colored strip of 43 scenes. *A Dental Catalogue* (1860). By W. B. Roberts, a New York dental manufacturer.

Among the American-made instruments on display were a superb set of pluggers for noncohesive gold, with hexagonal pearl handles and gold ferrules, marked S. S. W. (Samuel Stockton White) and H. C. (Henry Coy), and others, marked J. D. Chevalier, who opened the first dental depot in New York.

LEGISLATION

The Minister of Health, Mr. Iain MacLeod, introduced into the House of Commons on July 21 the new Dentist's Bill, the main objects of which are to give self-government to the dental profession, a recognized status to certain ancillary dental workers and to permit an experiment in the training of one type of ancillary dental worker who would extract and fill children's teeth under qualified supervision. The bill also provides a simpler procedure for admitting dentists trained outside Britain to the British register, and a further clause restricts the right of lay persons to carry on the business of dentistry through employment of registered dentists.

The bill's provisions are similar to those of the bill introduced by the government in the last Parliament, which got no farther than the House of Lords. It is proposed to give the profession self-government by establishing an independent General Dental Council. At present the statutory body is the Dental Board, which in some respects is controlled by the General Medical Council. The functions of the Dental Board and various powers of the General Medical Council would be transferred to the new General Dental Council. The new Council would consist of 41 members, 19 of them dentists chosen by the bodies which grant degrees or licenses in dental surgery and dentistry. Nine other members would be dentists elected by the profession, and there would be seven Crown nominees, of whom four would be laymen and three dentists. The other six members would be appointed by the General Medical Council.

The new Council would make regulations to establish classes of ancillary dental workers. Oral hygienists already have been trained to scale, clean and polish teeth in welfare and school clinics, under supervision of registered dentists, and the bill would enable the hygienists to work in private practice.

The experimental scheme provided for in the bill will be subject to the approval of the Privy Council, after consultation with the General Dental Council. There would be power to train ancillary workers who would be permitted under qualified supervision to extract deciduous teeth and to fill deciduous and permanent teeth.

Trainees reaching standards of proficiency would be employed in the national and local authority health services. A similar scheme operates in New Zealand and was favorably reported on in 1950 by a special dental mission. This type of ancillary dental worker would be employed for a trial period to assess the value of the work done.

ITEMS OF INTEREST

We welcomed the visit of Varaztad Kazanjian, M.D., famous plastic surgeon of the first world war and teacher of oral surgery in Boston. Dr. Kazanjian lectured at the Royal Dental Hospital, London.

Dr. J. Cameron, oral surgeon of Philadelphia also was welcomed by his many friends here in Great Britain.

Over 75 colleagues with their families from Great Britain are proposing to attend the 43rd annual meeting of the Fédération Dentaire Internationale at Copenhagen August 14-20, where the enrollment is expected to be about 800, including 55 dentists and their families from the United States.

Gerald H. Leatherman,
D.M.D., F.D.S.R.C.S.

DENTISTRY'S POLICIES TO BE SET AT ANNUAL SESSION; LEADING RESEARCHERS LISTED FOR SCIENTIFIC PROGRAM

Association policy on noninclusion of dentists under Old Age and Survivors' Insurance will come up for another look when the House of Delegates convenes in annual session October 17-20 in San Francisco. To date, eight resolutions on some aspect of the subject have been submitted. Other resolutions on proposed federal legislation recommend Association opposition to federal reinsurance of health programs and propose limits on the dental care to be provided members of the National Security Training Corps.

In addition, the House will consider resolutions urging a change in the date of National Children's Dental Health Week (the 1957 celebration would be the first affected), setting up principles for determining acceptability of dental prepayment plans and proposing revisions to the *Principles of Ethics*. Also to be examined are the suggestions of the Special Committee on Reorganization of Trustee Districts for changes in the composition of the districts and for a smaller House of Delegates.

REFERENCE COMMITTEES

Resolutions and Council reports will be submitted to the three standing and 12 reference committees, whose members have been appointed by Daniel F. Lynch, Association president. The appointments, with the three standing committees listed first, are:

Constitution and Bylaws • Fritz A. Pierson, chairman, Lincoln, Neb.; James Berney, Davenport, Iowa; James D. O'Farrell, Houston, Texas; Ernest B. Penn, Miami, Fla., and Herbert L. Taub, Jamaica, N. Y.

Credentials • Paul W. Zillmann, chairman, Buffalo; Herbert J. Hoppe, Cleveland, and Claude S. Williams, Hattiesburg, Miss.

Rules and Order • Paul K. Musselman, chairman, Newark, Del.; Floyd D. Ostrander, Ann Arbor, Mich., and George W. Redpath, Portland, Ore.

Dental Education • Harold E. Tingley, chairman, Boston; Walter T. McFall, Asheville, N. C., and Thomas P. Fox, Philadelphia.

Dental Research and Therapeutics • Arthur W. Kellner, chairman, Hollywood, Fla.; Frederick C. Baker, Hammond, Ind., and Frank C. Carothers, Garnett, Kan.

Dental Trade and Laboratory Relations • Homer D. Butts, Jr., chairman, Pittsburgh; Eugene W. Newman, Red Bank, N. J., and Roger V. Ostrander, Waterbury, Conn.

Federal Dental Services • Rulon W. Openshaw, chairman, Los Angeles; Thomas J. McDermott, Cleveland, and J. Melville Smith, III, New Orleans.

Hospital Dental Service • L. N. Larson, chairman, Fort Dodge, Iowa; O. E. Nobert, Rome, N. Y., and Thomas C. Starshak, Chicago.

Insurance • Fred S. Shandley, chairman, Seattle; Andrew M. Ballentine, Pulaski, Tenn., and Paul W. Clopper, Peoria, Ill.

Legislation • John T. Flynn, chairman, Scarsdale, New York; I. G. Bergh, Watertown, S. D., and F. J. Martin, Medford, Wis.

Miscellaneous Business • Willard Ogle, chairman, Dallas, Texas; A. B. Coxwell, Louisville, Ky., and E. H. Finnerty, Scranton, Pa.

Public Health • L. R. Ludwigsen, chairman, San Francisco; Theodore Behrens, St. Louis, Mo., and A. G. Twigg, Cumberland, Md.

Reorganization of Trustee Districts • James H. Keith, chairman, Evanston, Ill.; Matthew Beadine, Brooklyn, and Henry Colby, Minneapolis.

Report of President • E. D. Leifer, chairman, Washington, D. C.; James E. John,

Roanoke, Va., and H. O. Warrick, Enid, Okla.

Revision of "Principles of Ethics" • Earle S. Arnold, chairman, West Hartford, Conn.; R. Chester Dalgleish, Salt Lake City, and C. S. Foster, Cedar Rapids, Iowa.

ELECTION OF TRUSTEES

In addition to the selection of a president-elect, 3 vice-presidents and a speaker of the House, Trustees are to be elected for the First, Sixth, Seventh and Tenth Districts. Trustees whose current three year terms are completed are Charles I. Taggart, Arthur F. Schopper, Earl G. Jones and Lewis W. Thom.

SCIENTIFIC SESSION

A new twist will be added to the scientific program this year as dentists, used to sitting on the platform and discussing the health of the public, find themselves in the audience and themselves the topic of discussion. The emotional stresses of dental practice, liver disease and peptic ulcer, heart disease and the dentist and orthopedic conditions frequently seen in dentists will be discussed by a panel of physicians. Panelists are Donald C. Dodds, M.D., Oakland, Calif.; Douglas G. Campbell, M.D., San Francisco; Francis L. Chamberlain, M.D., San Francisco, and Floyd Jergesen, M.D., also of San Francisco. Moderator is C. Edward Rutledge of Richmond, Calif.

A second panel expected to be of major interest, "Further Considerations of New Methods for Cutting Tooth Structure," is to be moderated by Arne F. Romnes of Chicago. Panelists are Robert J. Nelsen of Washington, D. C.; William Sweeney, Ph.D., also of Washington, D. C.; John H. Aldes, M.D., of Los Angeles; Arne G. Nielsen of Bethesda, Md., and William Lefkowitz of Columbus, Ohio.

Thirteen symposiums and panel discussions are planned.

Table Clinics • In addition to the many clinics given by individuals, clinics will be presented by several schools and study clubs. Among them are four West Coast schools, the School of Dentistry of the University of Southern California, the School of Dentistry of the University of Washington, the College of Medical Evangelists and the School of Dentistry of the College of Physicians and Surgeons.

In addition, clinics will be presented by the University Ferrier Study Club, the Bay Area Armed Forces Prosthetic Study Group, the American Academy of Gold Foil Operators, the Odontic Seminar, the Oregon Crown and Bridge Research Club, the Detroit Dental Clinic Club, the Seattle-Tacoma Prosthodontic Seminar and the Vancouver Endodontic Study Club.

Projected Clinics • Projected clinics, a popular feature of last year's scientific session, are part of the program for San Francisco. In these presentations, the clinician demonstrates his talk with the use of slides projected on a large screen for easy viewing.

Motion Pictures • A new feature of the motion picture program, which will run daily during the annual session, is the group of films for television. These are kinescopes of live programs produced by dental societies for showing to the public. Forty-three films are scheduled for the full film program. None have ever been shown at an annual session and several are having their première. Of the 43, 20 were produced in 1955, 23 in 1954. Producers are dental schools, individual dentists, pharmaceutical companies and government agencies. Films are grouped according to the following topics: civil defense, anesthesia, full mouth rehabilitation, endodontics, and television.

Scientific Exhibits • Several prize winners are among the 45 exhibits which will

be on display during the annual session. Of the 45, 26 are being shown for the first time. The exhibits run in subject matter all the way from methods of teaching anatomy in the dental school to federal civil defense. Schools and associations have submitted 21 exhibits, federal agencies, 11 and individuals, 13.

JOURNALISM CONFERENCE

Dental editors from across the country will meet October 15 in the Fairmont Hotel at the Conference on Dental Journalism sponsored by the American Association of Dental Editors and the Council on Journalism. W. W. MacQueen, president of the AADE, will preside. A feature of the afternoon and evening meeting will be an address on the relation of dental literature to scientific literature in general. The speaker is Henry M. Leicester, Ph.D., chemist, teacher and researcher, and a leading figure in the fight for fluoridation in California.

Other essayists are Horace E. Aubertine, Ph.D., of San Francisco; John E. Gurley, researcher and dental editor, also of San Francisco, and John G. Rooks, executive secretary, California State Dental Association. Lon W. Morrey, Association editor, will describe the new abstract journal. J. C. A. Harding, member of the Council on Journalism, will speak on goals for the Council and the editors' association.

DENTAL HEALTH CONFERENCE

Dental health care programs for children will be in the spotlight at the Sixth National Dental Health Conference October 15 at the Mark Hopkins Hotel in San Francisco. Under discussion will be preschool dental health care plans, programs for the handicapped child, the ILWU-PMA (West Coast) dental health care program and the Richmond-Woonsocket studies. (The Richmond-Woonsocket studies were made to determine the dental needs of children in those communities during a given year and the dental manpower needed to meet these needs.)

A panel of educators and dentists will analyze the place of dental health care in the education system. Panelists are Mr. Henry M. Gunn, superintendent, Palo Alto Unified School District, Palo Alto, Calif.; William P. Humphrey, pedodontist of Denver; David B. Law, executive officer of the department of pedodontics, University of Washington, Seattle; David F. Striffler, director of the division of dental health, New Mexico Department of Public Health; Charles A. Sweet, dental director, Oakland Public Schools, Oakland, Calif., and Jacob M. Wisan, Department of Public Health, Philadelphia.

Luncheon speaker will be Francis T. Hodges, San Francisco, president of the California Physicians' Service. Advance reservations for the luncheon may be made through the Council on Dental Health at the Central Office.

STATE SOCIETY OFFICERS

Labor-management dental health care programs will be the topic of a morning panel at the conference of state society officers scheduled for the Mark Hopkins Hotel October 16. The panel, presided over by Percy T. Phillips of New York, includes Rudolph H. Friedrich, secretary of the Association's Council on Dental Health; Robert O. Schraft of the California State Dental Association; Harold J. Noyes of the Oregon State Dental Association; Allison G. James of the Southern California State Dental Association; Kenneth B. Edgers of the Washington State Dental Association, and John G. Carr of New Jersey, secretary of the Joint Committee on Dental Health Care.

Magnus C. Hansen, chairman of the Association's Council on Relief, and Walter E. Dundon, chairman of the Coun-

cil on Dental Trade and Laboratory Relations, will address the group. Dr. Hansen will discuss the Relief Fund Program, and Dr. Dundon will speak on illegal dental practices.

The luncheon address is to be given by Bernerd C. Kingsbury, the Association's president-elect. Lawrence R. Kiebler, economist, will discuss "Will the Inflation Spiral Continue?"

WHO MAY ATTEND

Those eligible to attend the annual session are Association members and their families, dental assistants, dental dealers and manufacturers, dentists holding membership in the National Dental Association, dentists from abroad, those exhibiting at the meeting, members of county or state medical societies, dental hygienists, dental laboratory technicians and dental students.

WHAT TO WEAR

The Committee on Local Arrangements states that San Francisco weather in October is expected to be mild with daytime temperatures in the mid 70's. Mrs. Robert O. Schraft, chairman of the women's entertainment committee, suggests that women bring lightweight wool suits or tailored dresses with small hats to avoid the effects of the Bay breezes. For evening wear, a silk dress with a light wool topcoat is adequate. Men are advised to wear fall suits and a light topcoat and felt hats.

TOURS

Three tours, especially tailored for dental groups, are planned in connection with the 96th annual session. One of the tours, originating in Chicago, is being conducted by the Carrick Travel Bureau of Oberlin, Ohio. A second tour, originating in Atlanta, Ga., is being conducted by the Moyers Travel Bureau, 34-38 Peachtree, Atlanta. The third tour, from Chicago, is sponsored by the Chicago Dental Society.

The Carrick tour leaves Chicago October 5 and takes a northern route to the West Coast through the Red River Valley of North Dakota, the Glacier National Park and the Kootenai River Canyon. Tour members will visit the Grand Coulee Dam, Seattle, Portland, Ore., Mt. Hood National Forest and the Shasta mountain region of northern California.

The Moyers tour, leaving Atlanta October 7, takes the southern route. Tourists will visit New Orleans, San Antonio and El Paso, Texas, and Juarez, Mexico. From there, the trip will take them to the Grand Canyon and into the Los Angeles area before heading north to San Francisco.

Sightseeing on the Chicago Dental Society tour, which will travel via the Great Northern Railroad, is planned through Paradise Valley, Yellowstone National Park, Mammoth Hot Springs, Towel Falls and Seattle. The Society is planning a trip to Hawaii also.

The return trips of all tours will visit additional points of interest.

The Association's 96th annual session will be held in San Francisco October 17-20. Visitors to this cosmopolitan city can eat in sidewalk restaurants serving sea food from the latest haul at Fisherman's Wharf (picture 1, facing page). They can walk through San Francisco's Chinatown, the largest Chinese settlement outside Asia, or ride a cable car as it pulls uphill past a Chinese pagoda (picture 2). The Japanese tea garden (picture 3) is situated in Golden Gate Park. Lovely Mission Dolores (picture 4), also open to visitors, was founded in 1776 by Spanish padres under the rule of Carlos III of Spain. The wall encloses a charming garden and a graveyard of early Spanish settlers. The Fairmont Hotel (picture 5), which overlooks the city, will be the meeting place of the House of Delegates.

UNUSUAL SOCIAL EVENTS PROMISED FOR ANNUAL SESSION

Reuben L. Blake, publicity chairman, writes as follows:

San Francisco awaits you! In addition to one of the most extensive scientific programs ever presented, a vast array of entertainment and recreational events has been planned for you.

Highlighting the social affairs will be the gala President's Dinner, "A Night in the Golden West," honoring President Daniel F. Lynch in the Sheraton-Palace's famous Garden Court; a cocktail party and special dinner featuring San Francisco's renowned foods in the Gold Bali Room; a ladies' luncheon and fashion pageant with the theme "East Meets West;" ladies' shopping tours through San Francisco's smart shops; a conducted tour of Nob Hill's distinctive homes; sightseeing bus tours of fascinating San Francisco, designed especially for photographers.

This city with personality offers many points of interest and scenic beauty which intrigue our countless visitors. A ride on one of our beloved cable cars to Fisherman's Wharf for a delicious seafood dinner; a restful sightseeing boat tour of San Francisco Bay with its 452 miles of landlocked harbor; a breath-taking view from Telegraph Hill or the "Top of the Mark;" our International Settlement, yesteryear's Barbary Coast; the fascinating shops in our romantic old-world Chinatown; our gigantic and colorful Golden Gate Park, with a sip of tea amid the oriental splendor of the Japanese Tea Garden; a trip across the Golden Gate Bridge to lofty Mt. Tamalpais and Muir Woods with its towering age-old redwoods. The ladies, especially, will want to tour world-renowned Gump's with its objects of art from the world over.

On your trip to or from San Francisco, why not plan a real vacation and sightseeing tour of our fabulous state?

There are literally dozens of scenic wonders, national parks and vacationlands which you can visit with very little additional time such as our redwood empire with its fishing, giant redwoods, old mines and logging camps; historic Sonoma Valley wine country; our world-famous Yosemite Valley; snow-covered Mt. Shasta and volcanic Lassen Peak and its lava beds; Lake Tahoe, the world's second largest lake to lie above 6,000 feet; the historic towns of our Forty-niner Gold Country in the Sierra Nevada foothills. We could go on and on, but come and see for yourself.

If you have a yearning to visit that exciting, tropical fairyland, the Hawaiian Islands, here is your chance. You are invited to attend the Pan-Pacific Dental Conference in Honolulu October 24-25 immediately following the annual session. There will be numerous social events and special tours of the outlying islands.

Your visit to the West can be a delightful and long-remembered adventure and a rare opportunity which may not occur again for many years.

Why not think it over?

Association Affairs

PUBLISH MID-YEAR INDEX TO DENTAL LITERATURE

The Index to Dental Literature for the first six months of 1955, prepared by the Bureau of Library and Indexing Service, will be available September 1 from the Subscription Department at the Central Office. An additional 1,473 articles were indexed during the last three months, bringing the total at the mid-year mark to 2,783. Items from 418 journals have been entered in the publication. The subscription rate for the quarterly compilations and the bound annual volume is $30.

Also completed by the Bureau is the

six-month index to THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. This publication may be obtained on request from the Subscription Department at the Central Office.

E. HAROLD GALE, FORMER COUNCIL CHAIRMAN, DIES

E. Harold Gale, of Albany, N. Y., former chairman of the American Dental Association Council on Legislation, died July 29 of a heart attack. He was 63 years old. Long active in the affairs of organized dentistry, Dr. Gale held many posts in the local, state and national dental associations. In 1918 he was secretary of the Third District Dental Society of New York and in 1921 became its president. He was a member of the executive council of the Dental Society of the State of New York, served as general chairman of the arrangements committee for the state group's meeting in 1941, and became president of the state society in 1950.

E. Harold Gale

In 1948, Dr. Gale was elected to the American Dental Association Council on Legislation. He served as chairman from 1949 through 1954. In his capacity as Council head, he testified for the Association before Congressional committees on many issues affecting dentistry, including such matters as increased dental fees under the VA outpatient dental care program, in support of technical assistance to states for fluoridation programs and for increased funds for the National Institute of Dental Research in Washington, D. C.

Dental editors at the Conference on Journalism held June 13 and 14 in Allerton Park, Ill., discussed methods of improving the quality of dental journals. Some 40 persons, representing 31 journals, participated in the conference which was sponsored jointly by the Council on Journalism and the American Association of Dental Editors.

BUREAU PREPARES POSTER AND CARD FOR TEENAGERS

A new poster, 9 x 16 inches, has been prepared for use in junior and senior high schools by the Bureau of Dental Health Education. Printed in yellow, blue and black on white, the poster shows an

unhappy teenager, head in hand, contemplating a group of young people dancing. The poster urges, "Don't miss the fun! Prevent tooth troubles!"

A 3 x 5 inch reduction of the poster has been prepared for use by the dentist as a throwaway or for enclosure with his monthly statements. The legend on the back of the card answers the question, "Why does the average teenager have so much more tooth decay than anyone else?"

Posters and throwaways may be obtained from the Order Department at the Central Office for the following prices: posters—one, 15 cents; 25, $3.10; 50, $5.00; 100, $8.35; 500, $39.70; throwaways—25, 40 cents; 50, 75 cents; 100, $1.45; 500, $6.90.

SUBSCRIPTIONS TO ABSTRACT JOURNAL NEAR 5,000 MARK

Nearly 5,000 persons from 24 countries are now charter subscribers to DENTAL ABSTRACTS, the Association journal which will contain abstracts from world dental literature. Periodicals of allied health professions also will be reviewed for articles of interest to dentists. Subscriptions have been received from practicing dentists, research men, students, teachers, technicians, libraries, hospitals, universities, laboratories, foundations and manufacturers of dental equipment.

The annual subscription price is $6 in the United States; $7 outside the country. Subscriptions may be obtained from the Association's Central Office in Chicago.

1955 SETS RECORD IN NUMBER TAKING NATIONAL BOARDS

Some 1,200 dental students will be taking National Board Examinations December 5 and 6 to bring the total tested in 1955 to a record 5,000. The new high was nearly 500 over the previous record established in 1954. Grades of the National Board of Dental Examiners are now accepted in 29 states and the Territory of Hawaii.

DENTISTRY REPRESENTED AT AUDIO-VISUAL CONFERENCE

Representatives of the American Dental Association and of the American Association of Dental Schools were among participants in the third annual meeting of the Audio-Visual Conference of Medical and Allied Sciences held July 24-27 in Chicago. Conference topics included a review of the latest technical developments in the 16 mm. film field as they affect the scientific film and included also a series of reports on the status of television in medicine and allied sciences.

Among participating groups, in addi-

tion to the dental organizations, were the American College of Surgeons, the American Hospital Association, the American Medical Association, the American Association of Colleges of Pharmacy and the Armed Forces Medical Library.

Representing the American Dental Association was Helaine Levin, film librarian.

EDWARD R. WHITE, JR., SON OF TRUSTEE, DIES IN ACCIDENT

As THE JOURNAL went to press, word was received that Edward R. White, Jr., son of Edward R. White, Fourth District Trustee, had been killed in an automobile accident August 16. The funeral was held in Jersey City August 20.

SUBSCRIPTS • Harold Hillenbrand, Association secretary, has been appointed a member of the Organizing Committee for the Twelfth International Dental Congress of the Fédération Dentaire Internationale to be held in Rome in 1957. . . . Dates of the 1956 State Secretaries' Management Conference have been changed. Instead of the June 11-13 date previously announced, the conference will be June 4-6. The change was necessitated to assure hotel accommodations. . . . Walter E. Dundon, chairman of the Association's Council on Dental Trade and Laboratory Relations, will appear on the program of the October 14-16 Los Angeles annual meeting of the National Association of Dental Laboratories.

Dental Societies

STATE GROUPS TO DISCUSS VETERANS' MEDICAL CARE

Organizations in the medical field will sit around the conference table with representatives of the American Legion September 27 in Indianapolis to discuss veterans' medical care from the point of view of the various organizations concerned. Sponsors of the conference, to which groups from 11 states have been invited, are the joint liaison committee of the Indiana state dental, medical and hospital associations, and the Indiana Department of the American Legion. In addition to the invitations extended to their counterparts in other states, the sponsors have invited managers of 54 veterans hospitals in those states as well as national representatives of all organizations concerned.

Speakers on the program will include William S. Middleton, M.D., chief medical director of the Veterans Administration; Mr. T. O. Kraabel, director of medical rehabilitation, American Legion; Admiral Dallas G. Sutton (MC, USN, retired), American Hospital Association; Elmer Hess, M.D., A.M.A. president, and Bernard J. Beazley, secretary of the American Dental Association Council on Federal Dental Services. Indiana Governor George N. Craig will welcome the delegates. Norman R. Booher, M.D., of Indianapolis, is chairman of the meeting.

STATE SOCIETY AIDS IN PLANNING NEW SCHOOL

The school liaison committee of the New Jersey State Dental Society met with officers of Seton Hall University in Newark, N. J., July 26, to discuss policy matters concerning operation of the new School of Dentistry. The discussion covered such areas as criteria for selection of faculty members, provision for research and hospital-school relationships. Representing the society were Edward J. White, Fourth District Trustee; John G. Campi, president of the state society;

Charles P. Crowe; William A. Giblin; George J. White; Benjamin Rosenwasser, and Alfred W. Nelson. Representing Seton Hall were Reverend Michael I. Fronczak and Dean Merritte M. Maxwell. The first class in dentistry is to be admitted in September 1956.

NORTH CAROLINA SOCIETY EMPLOYS EXECUTIVE OFFICER

The North Carolina Dental Society has hired a full-time executive secretary. He is Mr. Andrew Moreland Cunningham of Raleigh, N. C., who came to his new post September 1. Mr. Cunningham has a degree in economics and business administration. He has taught in the public schools of North Carolina and was assistant to the president of Peace College in Raleigh. In addition, he was district representative for international correspondence schools of Scranton, Pa.

Allen M. Ito of Honolulu (left), recently installed president of the Hawaii Territorial Society, discusses Society affairs with W. N. Yuen of Hilo, the new president-elect. Reelected at the June 15-18 meeting were Thomas M. Otake of Honolulu, treasurer; John H. Dewe of Honolulu, secretary, and Robert N. Ogawa of Hilo, assistant secretary.

BERNERD KINGSBURY ON PAN-PACIFIC PROGRAM

Bernerd C. Kingsbury, president-elect of the American Dental Association, will be a featured speaker at the Pan-Pacific Dental Conference in Honolulu, Hawaii. The Hawaii conference is scheduled for October 24-26, immediately after the American Dental Association's annual session. Other featured speakers are Cecil H. Bliss of Sioux City, Iowa; Walter T. McFall of Asheville, N. C.; Meigs Jones of Kansas City, Mo.; J. Roy Doty of Chicago, secretary of the American Dental Association Council on Dental Therapeutics, and Lon W. Morrey, editor of THE JOURNAL.

An extensive entertainment program is planned, including tours of the Islands, fishing trips and a luau (Hawaiian-style feast).

Persons wishing to register for the Conference may write Pan-Pacific Dental Conference, 3124 E. 14 St., Oakland 1, Calif.

ELECT OFFICERS FOR CALIFORNIA DENTAL PLAN

Officers were elected July 13 for the California Dental Association Service Plan, the nonprofit corporation sponsored by the California State Dental Association to provide a mechanism for handling indemnity-type dental health care plans. The officers are: Robert O. Schraft, president; C. Edward Rutledge, first vice-president; Walter J. Healy, secretary, and B. C. Kingsbury, Jr., treasurer. John G. Rooks was elected a vice-president and managing director.

LIST CLINICIANS FOR MIDCONTINENT MEETING

An all-day course on the hydrocolloid inlay technic will be presented at the 14th Annual Mid-Continent Dental Congress of the St. Louis Dental Society at

PAN-PACIFIC DENTAL CONFERENCE HAWAII OCTOBER 24 AND 25

Leis for Conference guests are made by (l. to r.) Mrs. George T. Aoki, Mrs. Noboru Asahina, Mrs. H. L. Houvener and Mrs. John Y. Kim.

This haul was made with a huge net that had been placed in a semi-circle from the beach of Oahu to the shore two hours before.

Hawaii's exotic gardens are background for the Conference.

the Jefferson Hotel in St. Louis. The Congress is scheduled for November 27-30. Clinicians for the course are Drexell Boyd; Ralph W. Phillips, B.S., and Frederick A. Hohlt of Indiana University School of Dentistry.

Other essayists are: Oliver Applegate of Ann Arbor, Mich.; Sanford M. Moose of San Francisco; William W. DeMerritt of Chapel Hill, N. C.; Norman C. Carlson of Lincoln, Neb.; Daniel Gehl of Milwaukee, Wis.; Harry Kaplan of Washington, D. C.; Ercell L. Miller of Columbia, Mo., and Jerome S. Grosby of St. Louis.

SUBSCRIPTS • The semiannual meeting of the Maryland State Dental Association will be held September 11-13 in Ocean City, Md. . . . November 6-8 are the dates of the Twelfth Annual Seminar of the Arkansas State Dental Association. The meeting will be held in Hot Springs. . . . The Committee on Scientific Exhibits for the Midwinter Meeting of the Chicago Dental Society requests that all applications for space be made before October 1. . . . Certain dental treatments, principally in hospitals, are now provided for under the Blue Shield and Blue Cross insurance plan in Georgia, according to an announcement by Charles Johnston, chairman of the legislative committee of the Georgia Dental Association. A revised program to include dental procedures was authorized recently by the Georgia State Legislature.

Federal

BILLS AFFECTING DENTISTRY AWAIT RETURN OF CONGRESS

A number of bills of importance to dentistry will be acted on in the second session of the 84th Congress when the Nation's lawmakers return to Capitol Hill next January. Among the measures are two, introduced in the closing days of the 1955 session, which would provide medical care benefits for servicemen's dependents.

One is a Defense Department proposal (S. 2720) and the other (H.R. 7806) represents the recommendations of the American Hospital Association. Both measures would limit federal responsibility for dental care of dependents of military personnel to emergency treatment except in areas outside the United States or in "remote" areas within the country where adequate civilian dental facilities are not available.

A plan proposed in both bills provides for medical care by civilian physicians under an insurance program. Dental care is not included except for that which is adjunctive to medical care in the hospital.

Awaiting the return of the Senate is a House-passed bill liberalizing Old Age and Survivors' Insurance benefits and including dentists but not physicians in its provisions.

The House will have before it a Senate-passed measure for aid to construction of research facilities including those of dental schools (S. 849). The House will consider also a committee-approved omnibus tax bill which contains, in somewhat less liberal form, the provisions of H.R. 9 and 10, the Reed-Jenkins-Keogh bills. These bills would allow dentists and other self-employed persons to set aside certain sums of money for retirement purposes and defer tax liability on these amounts until they draw on the principal and interest of the trust. The published

record of the hearings held on these measures shows that two out of three state dental societies sent letters or telegrams to the House committee considering the bills.

Also held over until January is an amendment approved by a subcommittee of the House Interstate and Foreign Commerce Committee to include dental schools in a measure providing grants for medical school construction. The Administration's health reinsurance proposal also will be up for debate.

LEO SCHOENY RESIGNS FROM RUSK ADVISORY COMMITTEE

The resignation of Leo J. Schoeny of New Orleans from the Health Resources Advisory (Rusk) Committee was announced August 4 by Arthur S. Flemming, director of the Office of Defense Mobilization. The Rusk Committee, of which Dr. Schoeny has been a member since its inception in 1950, helps develop policies on the Nation's health problems as they relate to defense mobilization. It serves also as the National Advisory Committee to the Selective Service System on the physician-dentist draft.

The Committee marked Dr. Schoeny's resignation with a resolution which expressed its appreciation for the "great contribution he has made to the general work of these Committees and the specific responsibilities he has undertaken in the field of dentistry." A successor to Dr. Schoeny will be appointed in the near future, Mr. Flemming said.

PENTAGON DRAFTS INCENTIVES FOR MILITARY DENTAL CAREER

A dental or medical career in the Armed Forces may be more attractive in the future if Congress in its next session approves a plan drafted by the Department of Defense. The program, designed to make such careers sufficiently attractive to bring in and hold more career officers, was presented to representatives of the American Dental Association and other health organizations at a Pentagon conference July 20.

The plan calls for pay credit for years spent in dental and medical education, higher starting ranks and bonuses for officers who contract to remain in service more than two years.

Drafted by an interservice task force headed by Rear Adm. E. W. Grenfell, the proposal is designed to meet what the Department of Defense characterizes as an "inordinately high rate of turnover" in the military medical services. The turnover, says a Pentagon report, "creates such demoralizing and unsatisfactory conditions of service for the remaining regular physicians and dentists that these few career officers are now resigning at almost twice the rate of new appointments."

The report points out that the "discriminatory doctor draft legislation cannot be extended for an indefinite time." To hold the needed health personnel the disparity between civilian and military incomes must be closed, states the report.

The Pentagon proposal is expected to be presented to Congress next term after its clearance by the Bureau of the Budget.

Representing the Association at the Pentagon July 20 meeting were Daniel F. Lynch, president; C. Willard Camalier, assistant secretary; Bernard J. Conway, secretary of the Council on Legislation, and Bernard J. Beazley, secretary of the Council on Federal Dental Services.

SUBSCRIPTS • Chester S. Keefer, M.D., special assistant for health and medical affairs in the Department of Health, Education and Welfare, resigned early in August. A successor has not yet been named.

Dental Education

MEDICAL EVANGELISTS DEDICATE DENTAL SCHOOL

The College of Medical Evangelists dedicates its new million dollar School of Dentistry building in Loma Linda, Calif., September 18, according to M. Webster Prince, dean of the dental school. The College's two year old dental school has been using facilities provided in the School of Medicine.

Space in the new two story building totals 50,000 square feet, all of which is air-conditioned. In addition to the laboratories and lecture rooms, the building contains a room for biological research, a clinical-medical laboratory and a demonstration room constructed so as to permit the taking of unposed color slides and motion pictures through a one-way observation window. The dental clinics have 133 chairs.

Willard C. Fleming of San Francisco, dean of the University of California School of Dentistry, will be a featured speaker at the dedication ceremonies.

ZUGSMITH MEMORIAL FUND ESTABLISHED AT PITTSBURGH

The Robert Zugsmith Memorial Fund, established as a tribute to the late Robert Zugsmith of the University of Pittsburgh School of Dentistry, was announced July 11 by William F. Swanson, dean of the school. Given by Ben Paul Brasley of Pittsburgh, a friend of Dr. Zugsmith's, income from the $5,000 fund will be used to make an annual award to one or more "worthy and meritorious" students.

Dr. Zugsmith was graduated from the University of Pittsburgh in 1903 and was a member of the faculty until 1952. At the time of his retirement, after 49 years of teaching, he was named professor emeritus of physiology in the School of Dentistry. He died May 11, 1955.

SCHOOLS ANNOUNCE FALL SEMESTER SCHEDULES

California • A postgraduate course in implant dentures to be conducted October 15 and 16, just prior to the American Dental Association's annual session, has been announced by the University of California College of Dentistry in San Francisco. The program is designed to acquaint the student with the results of research and experimentation in implant dentures rather than to qualify him to perform this type of dentistry.

Guest lecturers will be Col. Roy L. Bodine, chief of the dental service, William Beaumont Army Hospital, El Paso, Texas; Roland A. Grubb, Glendale, Calif.; John P. Knowlton, Seattle, and Theodore C. Lee of San Francisco.

In Los Angeles, the University Extension offers a general refresher course starting November 28 and continuing for nine weeks. Included in the course will be anatomy, anesthesia, chemistry, crown and bridge, dental materials, histology, materia medica and therapeutics, oral diagnosis, surgery, pedodontics and roentgenology. More than half the course will be devoted to laboratory technics and clinical procedures.

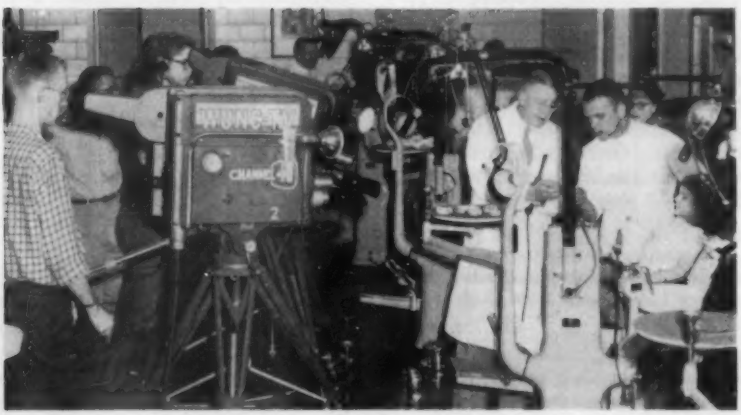
In addition, courses are offered in preventive dentistry, function and tooth guidance. A short refresher course in dentistry has been scheduled also. Information on these October and November courses may be obtained from the University Extension, 813 S. Hill St., Los Angeles 14.

Information on the State Board refresher course designed to prepare candidates for the January Board examination may be obtained from Murray T. McNeil, 1401 S. Hope St., Los Angeles 15.

Indiana • A limited enrollment course in construction of fixed bridges will be taught at the Indiana University School of Dentistry November 7-11 in Indianapolis. Students are required to bring handpiece, stones, burs, mandrels and disks for use during laboratory periods. The cost of teeth and facings is included in the registration fee.

Loyola (Chicago) • Loyola University School of Dentistry (Chicago) has scheduled a course for practicing oral surgeons October 10-14 under the direction of Joseph Kostrubala. Infection, trauma, neoplastic diseases and congenital deformities will be considered in the

With the new College of Medical Evangelists' School of Dentistry building in Loma Linda, Calif., as background, Dean M. Webster Prince (right) and Assistant Dean Ross Stromberg (left) look over landscaping details with architect and contractor. Dean Prince is shown in the insert also.



The School of Dentistry, University of North Caroline, presented its first one hour live television broadcast over station WUNC-TV June 14. Viewers within a 100-mile radius were able to see child patients receiving topical application of sodium fluoride, watch the insertion of a fixed space maintainer, the insertion of partial dentures, the placement of an amalgam restoration and the taking of roentgenograms. A second show, June 21, presented dentistry as a career. W. W. Demeritt, chairman of the University's TV committee of the division of health affairs, was master of ceremonies for the program.

course. Students will perform various types of operations on cadavers.

Also scheduled is a course in applied anatomy under the direction of Harry Sicher. Set for October 7-9, the lectures will be given at the cadaver while the region under discussion is being dissected. The following regions will be covered: triangles of the neck, muscles of facial expression, parotid gland, facial nerve, muscles of mastication, infratemporal fossa, pharynx and larynx, cranial base, nasal cavity, nasal sinuses and oral cavity.

New York • New York University announces four comprehensive courses in periodontics and oral medicine designed to develop the proficiency needed for specialization. All courses begin September 19. They run as follows: one academic year, full time; two years, full time; two years, half time; four years, half time. In addition, the school offers a refresher course in periodontics and oral medicine February 29 to May 10 and periodontics and oral medicine in the Spanish language April 2-27.

Northwestern • Short postgraduate courses in fifteen different dental subjects will be offered by Northwestern University Dental School during the academic year 1955-56. The subjects include courses in periodontics, dental medicine and pathology, operative dentistry, diagnosis and treatment planning, oral surgery, crown and bridge, pedodontics, orthodontics and endodontics. For further particulars apply to the director of dental postgraduate study, Northwestern University Dental School, 311 E. Chicago Ave., Chicago 11.

Pennsylvania • The University of Pennsylvania in Philadelphia lists the following courses for the fall semester: dental assistants' course October 24, two evenings a week for 52 class periods; dentistry for handicapped children, November 7-9; endodontics, October 5, one day a week for 11 weeks; oral diagnosis and roentgenology, January 2-13; partial dentures, November 14-19; periodontal therapy, December 12-16; advanced practices in functional treatment, November 7-11, and precision prosthesis and functional treatment, January 16-21.

Tufts • Tufts University School of Dental Medicine in Boston has announced its postgraduate courses for the next year. Included among them is a course in complete denture implants January 9-13 under the direction of Norman I. Goldberg and Aaron Gerschkoff and a course in temporary splinting and minor tooth movement in the management of periodontal problems January 16-18 taught by Leonard Hirschfeld. Courses are offered also in minor oral surgery, general anesthesia, fractures of the facial bones, electrosurgery and orthodontics. The dates of a previously announced participation course in periodontology have been changed. The new dates are November 7-11.

In addition, a course in periodontal treatment will be conducted January 10-14. The course has been developed in response to the increasing interest in the role of permanent splinting as part of periodontal treatment. Teachers will be Irving Glickman, Arthur Gold, Edward T. Fischer, Louis Alexander Cohn and Irving Hardy.

Virginia • Plans have been completed for the 1955-56 postgraduate session at the Medical College of Virginia School of Dentistry in Richmond. Courses of from three to six days are offered in eight subjects. In addition, opportunities exist for graduate study leading to degrees of Master of Science and Doctor of Philosophy. Information on the courses and degree programs may be obtained from S. J. Kreshover, director of postgraduate and graduate instruction at the College.

Washington • A refresher course entitled "Attachments and Stress Breakers for Bridges and Removable Dentures" is offered by the University of Washington School of Dentistry in Seattle October 4. Raoul H. Boitel, a graduate of the University of Zurich and the Northwestern University Dental School, will teach the course. Dr. Boitel is on a lecture tour of the United States.

SUBSCRIPTS • A teaching grant of $30,000 has been awarded to the University of Tennessee College of Dentistry by the federal government's Children's Bureau. The grant will be used in the postgraduate pedodontics department. . . . The new six million dollar building of the School of Dentistry, University of Texas at Houston, opened August 15 with an enrollment of 120 junior and senior students for summer study.

Public Health

DENIES SODIUM FLUORIDE IS INDUSTRY'S WASTE PRODUCT

The Aluminum Company of America last month denied that sodium fluoride is a waste product of aluminum manufacture. Opponents of water fluoridation often claim that ALCOA promotes adoption of the health measure in order to get rid of otherwise unusable fluorides.

These allegations were denied by the company in a letter signed by John H. Furet and addressed to David J. Smith, associate research dentist of the New York State Department of Health.

"Sodium Fluoride as produced by us is not a waste product of the aluminum industry," the company official wrote, "and over the past years other companies in the United States having no connection with the aluminum industry have and do produce Sodium Fluoride by the same method we use. We supply very little Sodium Fluoride for water fluoridation because we believe our fluorspar [a source of fluorine] reserves are needed for the production of other fluoride chemicals needed in our own production of aluminum. We make no direct sales of Sodium Fluoride, all of our production being handled through chemical distributors."

The letter pointed out also that a high percentage of sodium fluoride is obtained from phosphate rock. "We have no operations involving phosphate rock," the letter stated.

FLUORIDATION PROGRESSES IN EAST, MIDWEST AND WEST

Fluoridation moved ahead in three widely separated places last month. In New Hampshire a bill to require a referendum on the issue of fluoridation was defeated in the legislature after a hard fight by the New Hampshire Dental Society. In the Midwest, the nation's second largest city, Chicago, moved closer to the start of its program as initial contracts for 2,700 tons of fluoride were awarded by the city purchasing agent. And on the Pacific Coast, the public health measure was extended to all of San Francisco.

The San Francisco program, begun in August 1952, had served about 80 per cent of the city's 742,000 population. Extension of the measure, marked by the opening of two new treatment plants in San Mateo County, completed the program for San Francisco and brought fluoridation to nine Peninsula cities with a total population of nearly 156,000.

In addition to Chicago's population of more than 3,600,000, some 500,000 residents of 51 suburbs also will be served by that city's project. Eight of these suburbs already fluoridate their water.

PROPOSE EXPANSION OF FOOD AND DRUG ADMINISTRATION

A four-fold expansion over the next decade in the personnel and facilities of the federal Food and Drug Administration has been recommended by a government committee. The committee, appointed by Oveta Culp Hobby, former secretary of the Department of Health, Education and Welfare, was headed by Mr. G. Cullen Thomas, vice-president of General Mills. In making its recommendation, the committee pointed out that the F.D.A.'s enforcement personnel has decreased since 1941, while population and drug output have increased rapidly. Under these conditions, the committee said, the F.D.A. cannot fulfill its obligation to protect the public health.

The F.D.A., among its other duties, checks the labeling and safety of most of the local anesthetics, analgesics, antibiotics and other drugs used by dentists, as well as all dentifrices, including those which contain fluorides and penicillin.

DENTAL DIRECTOR SOUGHT FOR TEXAS HEALTH DEPARTMENT

The position of director of the division of dental health is now open in the Texas State Department of Health. The director will be responsible for developing and maintaining a state-wide program of dental health under the direction of the Commissioner of Health.

Minimum qualifications are D.D.S. and M.P.H. degrees, five years' practical experience including two years of administrative responsibility in a dental public health program, and eligibility for licensure in Texas. The salary range is $9,720 to $12,120. Further information may be obtained from the Merit System Council, Texas State Department of Health, 814 Littlefield Bldg., Austin, Texas.

WILLIAM H. SEBRELL, N.I.H. DIRECTOR, RETIRES

Assistant Surgeon General William H. Sebrell, Jr., director of the National Institutes of Health, retired August 1 after 30 years of service. He will be succeeded by James A. Shannon, M.D., presently an N.I.H. associate director.

Dr. Sebrell will become research consultant for the American Cancer Society and will direct its institutional research grants program.

Studies on the B vitamins earned Dr. Sebrell a worldwide reputation as a medical scientist. He is known also for his work on pellagra and ariboflavinosis. In the early thirties he was interested in the relation of fluorine to mottled enamel and published several papers on the subject. For many years Dr. Sebrell was a member of the International Association for Dental Research.

SUBSCRIPTS • The dental health section of the American Public Health Association has published the program for the section meeting which is part of the APHA November 14-18 conference in Kansas City, Mo. Theme of the APHA meeting is "Where Are We Going in Public Health?"

National Defense

NAVY DENTAL SERVICE CELEBRATES 43RD BIRTHDAY

August 22 marked the 43rd birthday of the Naval Dental Service, announced Rear Admiral R. W. Malone, chief of the Dental Division. The Navy Dental Service was established August 22, 1912, when Congress authorized the appointment of 30 acting assistant dental surgeons. At present there are about 1,900 dental officers, 67 medical service and warrant officers and 2,650 dental technicians providing care for Navy and Marine Corps personnel.

Some idea of the magnitude of this responsibility can be gotten from the fact that over 90 per cent of incoming recruits require dental treatment, said Admiral Malone. In addition, about 1,000,000 active duty personnel also are cared for by the Naval Dental Service. During 1954, he said, over 2 million patients received treatment.

NOTICE FOR PHYSICAL DOES NOT MEAN IMMEDIATE CALL UP

Those 1-A dentists in Priorities I, II and III who will not reach 46 this year and who have not been examined by their local draft boards since August 1, 1954, have been receiving notices to report for

re-examination. The notices do not mean induction is imminent, however. Information received previously indicates that the Army will have sufficient manpower to meet its needs at least until 1956.

DEFERMENT POSSIBLE FOR DENTAL TEACHERS

Local draft boards have been requested to give careful consideration to the occupational deferment of teachers in dentistry, medicine, mathematics, physical and biological science. In a bulletin issued in amended form July 13, the national headquarters of the Selective Service System urged consideration to teacher deferment as high schools and colleges are having difficulty in obtaining sufficient faculty members.

Capt. Lawrence J. Shea (center) received a certificate for outstanding service from the Second United States Army May 22. Captain Shea was honored for "outstanding professional skill and the exceptional doctor-patient relationship" he established at the Army hospital at Fort Monroe, Va. His example, stated the certificate, instilled in those who worked with him "the desire to achieve excellence in the performance of their duties." With Captain Shea is Lt. General Dahlquist and Mrs. Shea.

SUBSCRIPTS • President Eisenhower last month signed into law the military reserves bill. The bill provides that within 60 days of the law's enactment, the National Security Training Commission shall submit to the Secretary of Defense recommendations for the health care of reservists. The American Dental Association has urged a "realistic approach" to the scope of dental care for the six-month trainees. . . . Encouraged by the success of its senior dental student program, the Navy Bureau of Medicine and Surgery will launch a senior medical student plan this fall. Fourth year students will be commissioned as ensigns with full pay and allowances and as return payment will be obligated to serve an extra year on active duty.

International

FRENCH, MEXICAN AND GREEK DENTISTS CALL CONGRESSES

Three dental congresses have been scheduled for the fall months of this year. They are the Second Panhellenic Dental Congress to be held in Athens, Greece, September 25-30; the Third International Dental Congress in Mexico City, October 23-28, and the 29th Journées Dentaires Internationales de Paris, November 21-27. Proceedings of the French meeting will be translated into four languages for the convenience of visitors from other countries. Lectures are planned in nine areas of dentistry, each lecture to be followed by discussion from the floor. Table clinics and social activities also have been announced by the French group.

American dentists planning on attending any of these three congresses are

asked to contact Harold Hillenbrand, American Dental Association secretary, at the Central Office.

MEXICAN SOCIETY TO CONDUCT ENDODONTICS COURSE

The Mexican Society of Endodontics announces its third annual postgraduate course in endodontics to be given by Yury Kuttler, D.D.S., M.D., in Mexico City December 4-10. Information on the course may be obtained from Sociedad Mexicana de Endodoncia, Hamburgo 250-401, Mexico D.F.

NEW DEAN NAMED FOR ARGENTINE SCHOOL

Professor Alfred F. Banfi has been elected dean of the College of Dentistry of the National University of Buenos Aires, reports Ricardo Augusto Crespi, THE JOURNAL'S correspondent. New president of the University is Ricardo Bernasconi Cramer. Secretaries for the dental school appointed by Dr. Banfi are Luis E. Moretti and Manuel S. Luna.

Dr. Crespi reports also that the Asociación Odontológica Argentina will hold its 12th Jornadas November 7-9. The meeting is to have an international character as clinicians have been invited from North America, France and other countries of Latin America. The Jornadas mark the 58th anniversary of the Argentine association and the 25th anniversary of the first "clinic week."

FRANCISCO PUCCI, EMINENT PERIODONTIST, DIES

Francisco M. Pucci, eminent Uruguayan periodontist, died March 2, 1955, in Montevideo. Dr. Pucci was the author of many publications, including two important works entitled *Periodontics* (which ran three editions) and *Radical Procedures* (two volumes). He served also as editor of the journal *Odontologia Uruguaya*.

Among the many professional societies to which Dr. Pucci belonged were the International Association of Dental Research, the International College of Dentists and the American Academy of Periodontology. In 1953, the 13th Congress of the Arpa Internationale (Association

Students at the dental college of Seoul National University use microscopes donated by the American-Korean Foundation. Observing the students are (l. to r.) Acting Dean Pak of the dental school, Howard Brooks, local AKF representative, and Lt. Col. C. W. Sober, Korea Civil Assistance Command Dental Adviser. American dentists last month began a drive to send books and periodicals to Korea's dental schools.

Wallace D. Armstrong, Ph.D., head of the department of physiological chemistry at the University of Minnesota and noted researcher, lectured in Stockholm, Sweden, May 26 and 27. He has been elected an honorary member of the Swedish Dental Society and honorary doctor of odontology at the Royal Dental School of Stockholm. Seated (l. to r.) are: Helge Berggren, Prof. E. Abramson, chief of the Swedish Public Health Service, Dr. Armstrong, Henry Beyron, president of the Swedish Dental Society, and Prof. Yngve Ericsson of the Royal Dental School.

for Research in Periodontal Disease) awarded him an honorary membership. In addition, Arpa had proposed him for principal reporter of the periodontics section of the Fédération Dentaire Internationale's Rome Congress in 1957.

ARPA ESTABLISHES PRIZE FOR PERIODONTAL RESEARCH

A prize to encourage research in periodontics has been established by Arpa Internationale (Association for Research in Periodontal Disease) in the name of René Jaccard, its founder and former president.

A bronze medal and certificate will be awarded every two years for the best scientific investigation published during the preceding period. The person chosen winner need not be a member of Arpa. His paper may have been published in a scientific journal or may be submitted directly to the president of Arpa. All papers must be submitted five months prior to the Congress at which they are to be judged. The first prize will be awarded at Arpa Internationale's 1957 congress.

SUBSCRIPTS • Mario M. Chaves became dental officer of the Health Promotion Branch of the Washington office of the Pan American Sanitary Bureau July 15. The Bureau is the regional office of the World Health Organization. Dr. Chaves is a native of Brazil and holds both M.D. and D.D.S. degrees. . . . Johann Ambrosius Barth, a German publishing house internationally known for its publications in the health sciences, celebrated its 175th year of operation July 1. . . . The 19th annual dinner meeting of the Pan American Odontological Association will be held December 7 at the Waldorf-Astoria Hotel in New York.

General

NATIONAL MAGAZINES CARRY DENTISTRY'S STORY

An article entitled "Should Your Child Be A Dentist?" will be carried in several national circulation magazines in October. The article, prepared in cooperation with the American Dental Association, is part of a series of institutional advertisements of the New York Life Insurance Company. It will appear in *Colliers* (on the newsstands September 29); *Ladies Home Journal* and *Saturday Evening Post* (both on the stands September 27).

Part of a series describing various careers which has evoked considerable favorable comment, the article points out the advantages of being a dentist. It was prepared by Philip E. Blackerby, Jr., as told to Morton Hunt. Dr. Blackerby is chairman of the Association's Council on Dental Education.

Available in reprint form, copies may be obtained singly or in quantity from the Public Relations Department, New York Life Insurance Co., 51 Madison Ave., New York.

OHIO REMOVES BAN ON NONSUGAR SWEETENED DRINKS

The sole remaining state barrier to the sale of nonsugar-sweetened beverages was removed August 30, the effective date of a newly enacted Ohio law permitting artificial sweeteners in diatetic beverages, according to a June announcement made by Abbott Laboratories, manufacturers of Sucaryl (cyclamate).

CLOSED CIRCUIT TV TO CARRY CHILDREN'S DENTISTRY

A major attraction at the San Francisco meeting of the American Society of Dentistry for Children will be closed circuit television from the operating rooms of the College of Physicians and Surgeons. The meeting is October 15 and 16. Among clinicians are Joe G. Sweet of Oakland, Calif.; John Tocchini, dean of the College of Physicians and Surgeons, San Francisco; Roy Weinheimer of Oakland, and Edward S. Mack of San Francisco. Panelists discussing "Re-evaluation of Vital Exposed Pulps" are John Sowden of San Francisco, Max Nacht of Vancouver, David Law of Seattle and Ralph McDonald of Indianapolis. Moderator is I. Irwin Beechen of Oakland.

PREVENTIVE DENTISTRY IS SYMPOSIUM SUBJECT

Members of the health professions have been invited to attend a symposium on newer concepts in preventive dentistry sponsored by the Committee of Dentists for Preventive Oral Medicine October 15 at the Sir Francis Drake Hotel in San Francisco. The symposium will emphasize oral medicine in general practice, according to Thomas M. De Stefano, secretary.

IOWA STUDENT RECEIVES AMERICAN COLLEGE AWARD

Clifton D. Adams, a 1955 graduate of the College of Dentistry, State University of Iowa, has been awarded the $2,500 Teacher's Training Fellowship of the American College of Dentists, Otto W. Brandhorst, A.C.D. secretary, announced June 24. Dr. Adams, who will receive his teacher's training in prosthetic dentistry, was selected from candidates proposed by the various dental schools. He is the first student from the State University of Iowa to receive this award.

Dr. Adams graduated from dental

school with honors. He received the Alpha Omega award for maintaining the highest grade point average for the four year enrollment. He was elected also to Omicron Kappa Upsilon, the national honorary dental fraternity.

The American College of Dentists awards the Teacher's Training Fellowship annually.

Fanny Z. Miner

EXTRACTIONS NEED NOT BE AVOIDED IN POLIO SEASON

There has been no evidence to correlate the incidence of poliomyelitis with extractions or other oral surgical procedures according to the members of the editorial board of the JOURNAL OF ORAL SURGERY. The opinions of board members were sought after the National Foundation for Infantile Paralysis, Inc., suggested that such dental procedures be postponed during the polio season. The members stated that dental procedures are different from procedures such as tonsillectomies, which, it has been suggested, also should be postponed.

FANNY Z. MINER, PIONEER WOMAN DENTIST, DIES

Fanny Z. Miner, claimed to be the oldest practicing woman dentist in the United States, died June 26 in Spokane, Washington. She was 88 years old. Dr. Miner was in active practice until her death. She had been practicing for 52 years. A graduate of Western Dental College, Kansas City, Dr. Miner received a golden diploma from the school two years ago. She was a member of the Spokane district dental society.

Dr. Miner was the daughter of Mr. and Mrs. John H. Brockman, who traveled from the Middle West to Oregon by immigrant train in 1881. While she was a young woman the family purchased a railway Pullman car and traveled throughout the Middle West for 14 years, later returning to the West Coast. The family took up residence in Spokane, and Dr. Miner's brother and sister studied dentistry. Dr. Miner followed their example. Her brother, D. R. Brockman, practices in Rockford, Wash.

APPLICATIONS ACCEPTED FOR RESIDENCIES AT MOUNT SINAI

The department of dental and oral surgery of Mount Sinai Hospital in New York is now accepting applications for internships and residencies for the year beginning July 1956. Interviews will be held in the fall. Further information may be obtained from the hospital, Fifth Ave. and 100 St., New York 29.

HILLIARD R. NEVIN, NOVOCOL OFFICIAL, HURRICANE VICTIM

Hilliard R. Nevin, head of the Novocol Chemical Manufacturing Co., died August 12, a victim of Hurricane Connie. Dr. Nevin, his wife and two children were drowned when a 63 year old 182 foot schooner "The Levin J. Morel" capsized in Chesapeake Bay. Dr. Nevin was 42 years old.

On graduation from the University of Toronto Dental School in 1938, Dr. Nevin joined the Novocol organization of which his father was founder. In 1950 he became head of the company and, in addition to his other duties, edited No-

vocol's magazine *Modern Dentistry*. He was coauthor of two textbooks, *Conduction, Infiltration and General Anesthesia in Dentistry* and *Problems in Dental Local Anesthesia*. Dr. Nevin lectured on anesthesia technic in an extensive tour of Latin America in 1953. He was a member of the New York State Dental Association and of the Second District Dental Association.

PROGRAM REPORTED FOR BUFFALO ALUMNI MEETING

Seven speakers have been announced for the University of Buffalo School of Dentistry Alumni Association's 53rd annual meeting, which is being held in cooperation with the Eighth District Dental Society of the State of New York. The meeting is scheduled for October 10 at the Hotel Statler in Buffalo.

On the program are: Victor H. Dietz of St. Louis; Dean E. Babbage, M.D., of Buffalo; Robert Errich, M.D., of Philadelphia; Paul J. Aufderheide of Cleveland; F. Gordon Anderson of Toronto, Canada; Ernest Lewis of Pittsburgh, and Dogan M. Perese, M.D., of Buffalo.

OPEN DENTAL ANTHROPOLOGY LABORATORY AT ZOLLER

A new laboratory for furthering the study of mutual problems in dentistry and physical anthropology has been completed at the Zoller Memorial Dental Clinic, according to Frank J. Orland, Clinic director. The announcement was made August 1. Opening of the laboratory under the guidance of Albert A. Dahlberg, research associate in anthropology, makes possible the offering of a fellowship in dental anthropology to qualified dental graduates. The new laboratory is expected to become a leading center of dentitional studies.

Also • Alpha Omega headquarters at the St. Francis Hotel in San Francisco will be open three days, October 15-17, the fraternity announces. A stag breakfast and dinner dance are features of the meeting. . . . The American Association of Women Dentists will meet October 16 and 17 at the Bellevue Hotel. . . . Also among San Francisco dental meetings is that of the American Academy of the History of Dentistry October 14 at the Mark Hopkins. Three Californians, J. B. Saunders, M.D.; Allen R. McDowell and Vivian A. Prindle, will discuss the history of dentistry on the West Coast. . . . M. C. Hansen, chairman of the American Dental Association Council on Relief, is endeavoring to make a complete collection of Association Relief Seals. Persons having seals of pre-1945 vintage are asked to communicate with Dr. Hansen, 420 Seventh St., Racine, Wis. . . . On October 30, 31, November 1 and 2 the Great Lakes Society of Orthodontists will hold its annual session; location: Neil House, Columbus, Ohio. . . . The Ohio State Dental Assistants Association Certification Examination is scheduled for November 13 at the Ransom and Randolph Co., Rose Bldg., Cleveland. . . . The Northeastern Society of Orthodontists meets October 24 and 25 in New York.

The Reader Comments

THE JOURNAL *devotes this section to comment by readers on topics of current interest to dentistry. The editor reserves the right to edit all communications to fit available space and requires that all letters be signed. At the request of the author, signatures will be deleted before publication. Printed communications do not necessarily reflect the opinion or official policy of the Association. Your participation in this section is invited.*

GLASS BEAD STERILIZERS

I have had many inquiries regarding the use of glass bead sterilizers for sterilization of root canal instruments. The glass bead sterilizer is simply a modified version of a molten metal sterilizer in which glass beads have been substituted for the metal. Work carried out in our laboratory by Seymour Oliet has shown that the size of the glass beads is important, as large glass beads provide poor contact between the beads and the object to be sterilized, so that sterilization is not always attained within a reasonable time. The beads recommended for this purpose are about as fine as grains of sand, are inexpensive, and are readily available from optical supply sources.

In the electrically operated sterilizer, there is a difference in temperature of as much as 30°C. (86°F.) between the beads near the surface and those at the base of the sterilizer. The instruments, absorbent points, or cotton pellets should therefore be immersed deep within the well, or else the time of sterilization should be increased. In the type of sterilizer which fits over a Bunsen flame, the heat may be increased by increasing the flame slightly. A suitable thermometer for both types of sterilizers, imbedded in the glass beads, is a necessity. The temperature should be around 225°C. (437°F.) but not above 250°C. (482°F.), as the temper of fine instruments may be drawn at the higher temperature. The molten metal sterilizer can be converted readily to the glass bead type by pouring the molten metal from the well and filling it with glass beads.

All root canal instruments must be clean and dry before immersion in the glass bead sterilizer; otherwise sterilization of the instruments might not be attained. Thoroughly cleansed root canal instruments such as reamers, files, and broaches may be sterilized in the glass bead sterilizer in five seconds; absorbent points and cotton pellets require ten seconds. The time factor for sterilization is therefore the same as in a molten metal sterilizer, but the advantage is that there is no metal to cling to the instrument on its removal from the sterilizer, and no dross to be removed from the surface.

Louis I. Grossman, Philadelphia

DENTISTS UNDER 50 WON'T BENEFIT

May I register my sincere opposition to the inclusion of self-employed dentists in the federal old age retirement system.

It is my opinion that dentists under age 50 have little or nothing to gain financially from such a program. In addition, I feel that it is another step toward the abolition of personal privacy and initiative.

W. M. Patterson, Jr., Jacksonville, Fla.

COMPULSORY SAVING UNDER O.A.S.I. BELIEVED DESIRABLE

I have read carefully in the June issue of THE JOURNAL the thorough exposition by the Council on Legislation relative to the cost and benefits of O.A.S.I. I have noted also the letter by Carl F. Damerow in which he vehemently supports the Association policy of excluding dentists from O.A.S.I. coverage.

After reading both these articles, I became more firmly convinced that the inclusion of dentists in the benefits of O.A.S.I. is beneficial, desirable and essential for the majority of the members of our profession.

The whole discussion boils down to this question: Is it or is it not desirable to institute a system of compulsory saving in order to provide a prop for old age when physical faculties begin to fail and the efficient performance of physical work, such as is required in the practice of dentistry, can no longer be executed adequately.

How many people kick themselves because they have not taken out more life insurance or annuity policies when with a little effort they could have managed the cost of the premiums? O.A.S.I. is just what is needed—

a compulsory modest saving for a day when income ceases and savings are needed.

For the dentist who has not succeeded in building up an adequate estate against the contingency of full or partial retirement, and these I believe are the majority, the benefits of O.A.S.I. may mean the difference between becoming an object of charity, an inmate of a home for the aged, a burden on his family —or a self-respecting, self-supporting individual. As for the dentist who is able to build up an adequate estate, O.A.S I. can be looked on as one more income policy to be added to the several he undoubtedly carries.

No private insurance company has been able to aproximate the benefits and costs of O.A.S.I. There is only one agency that can manage such a program, the U.S. government. I believe that the Association is performing a disservice to its membership by obstructing legislation which would include our members in the O.A.S.I. benefits.

The argument of "creeping socialism" is, mildly speaking, irrelevant. O.A.S.I. is the law of the land, created and augmented by our elected representatives. It can hardly be considered good citizenship to obstruct, on political grounds, the development of a policy which has the backing of both our great political parties.

R. Sharenson, Brookline, Mass.

O.A.S.I. BENEFITS GREATER THAN LEGISLATION COUNCIL STATES

In the July 1955 issue of THE JOURNAL the Secretary of the Council on Legislation of the American Dental Association states: "The best estimate of life expectancy for the dentist and his wife is 70 years for the dentist and 75 years for his wife. If this hypothetical dentist [entering the O.A.S.I. system in 1955 at the age of 25 years] retires at age 65 and applies for his benefits, he will receive the yearly maximum in benefits until his death at age 70, a total of $6,510." Including the wife and widow benefits, the "total benefits for the family will be $15,819 for a tax contribution of $8,460."

The basic question that now arises is the statement about the life expectancy of 70 years for the dentist who lives to begin receiving his Social Security benefits at age 65. A look at the dental obituary columns of this same publication shows 155 listings with ages at the time of death. Eighty-five or 56 per cent died at age 65 or over. According to the article, these 85 dentists, who would have lived long enough to have been eligible for retirement benefits at age 65 if dentists had been included under O.A.S.I., should have had an average death age of 70. But according to the obituary listing the average age at death of these dentists was not 70 but 77.

According to the figures given by the Council on Legislation, the average dentist in this group, if collecting retirement benefits under O.A.S.I., would have received an additional $13,675.20 for having lived seven years beyond the Secretary's best estimate of his death age. Thus the average dentist and his wife would have received $29,494.20.

Of the remaining 44 per cent of the listed deaths, 24 or 15 per cent died before age 54. This second group, as stated in the article, may have surviving children under 18 who would, along with the widow, be eligible for substantial benefits possibly amounting to many thousands of dollars. The 29 per cent who died between 54 and 65, an age before O.A.S.I. retirement benefits would begin, probably had no surviving children under 18 and therefore would have had little survivors' insurance payable.

But their widows on reaching 65 (or earlier under the new laws now being considered by Congress) would be eligible for many thousands of dollars in benefits payable throughout the rest of their lives. It might be of value for more of us to read THE JOURNAL completely, including the obituary listings, in our attempt to adequately determine the value and benefits receivable from the Old Age and Survivors' Insurance program.

It certainly seems a strange paradox that the welfare of 71 per cent of all the dentists in the United States should be subjugated to the questionable whims of the 29 per cent whose benefits may be reduced because of their untimely death between 54 and 65. Who among us can say when we will die? The odds are heavily weighted in favor of the 71 per cent. The future welfare of every seven out of ten dentists practicing today is being seriously hampered because dentists are still excluded from the O.A.S.I. program. It is certainly the duty of organized dentistry to support this majority now before it is too late.

Earl S. Elman, Chicago

Editor's note • The article by the Secretary of the Council on Legislation in the July 1955 issue of THE JOURNAL presented the expected retirement benefits of a dentist entering O.A.S.I. at age 25 or approximately the age at which most dentists graduate from dental school. Dr. Elman's method of calculating expected retirement benefits is based on life expectancy at age 65 and fails to take into account the 40 per cent of dentists who will

die before reaching 65. It is true, of course, that survivors' benefits would be payable to the dependents of some of the dentists who would die before reaching 65.

OBJECTS TO PAYING O.A.S.I. BENEFITS FROM CURRENT TAXES

Permit me to make a few remarks on O.A.S.I. in answer to Ralph W. Thompson's letter in the August issue of THE JOURNAL. The interest on the 22 billion dollar surplus of O.A.S.I. is not enough to cover benefit payments. Current security taxes are used to pay these benefits. Current taxes are the source of the 22 billion dollar surplus. Moreover, funds are invested in government bonds, which are the obligation of all the people—not just of those covered by O.A.S.I. Paying dividends or benefits out of current deposits is what we put Mr. Ponzi in jail for, and that is exactly what Uncle Sam is doing with Social Security funds.

Dr. Thompson doesn't believe the U.S. government could default on anything. In my opinion, it defaulted on its obligation to pay gold for gold certificates when this country went off the gold standard.

It will take many years to demonstrate the fallacy of Social Security, but the fallacy will be exposed some day. Meantime, the only course for a self-employed dentist is to take O.A.S.I. if the House of Delegates so decides, realizing that it is not creeping socialism—it is socialism, without any adjectives. The group taking care of the individual—there could not be a better definition of socialism.

R. C. McKelvey, Pittsburgh

DOUBTS ACCURACY OF COUNCIL REPORT

The recently published Council on Legislation's report on O.A.S.I. costs and benefits (*J.A.D.A.*, June) does not strike me as a clarifying or unbiased statement of the facts. Furthermore, some of its basic premises are highly questionable.

For instance, the report states, "A dentist enters the O.A.S.I. system in 1955 at age 25." Let's check this. A young man graduates from high school at 18, undergraduate and professional schools take seven to eight years, military service, two years, internship, 1 year. Therefore, the age at entering practice is actually 28 or 29, a difference of three or four years from the figure of the Council on Legislation.

"Our hypothetical dentist . . . would probably marry a girl age 22." I have searched in vain for this dentist through the Census Bureau figures, the *World Almanac*, *New York Times* and through other statistical literature. My suspicion is—he isn't there.

"Consideration of children's benefits may be disregarded in our analysis of retirement benefits to be received under O.A.S.I. by the dentist and his wife." Official reports of the Social Security Administration, February 1955, show 7,086,060 persons received O.A.S.I. checks; of these, 1,176,213 were children. Thus of every seven Social Security checks, two were in the category of survivors' insurance benefits. Two sevenths is a large fraction, and it would appear incredulous that a responsible study should overlook so large a factor in the Social Security set-up. Many of my younger friends feel that survivors' insurance is the most important of all O.A.S.I. benefits.

The Council offers a series of impressive looking tables. One table computes an investment equal to Social Security taxes over 40 years at 3 per cent, an amount totaling $15,418.64. Somebody should calculate the cost of liability, fire, theft, automobile, hospital and other insurance we carry. We buy them for protection, and we hope never to collect on them.

Tables 2 and 4 are purely hypothetical. They are based on a dentist of 65 dying at age 69 and his wife of 62 dying at 74. But the National Office of Vital Statistics states that at 65 male life expectancy is 13 years and female expectancy at 62 is 17.6. The Council lost 9 years of the dentist's life and 5.6 years of his wife's life. This oversight adds up to $15,789.60 in additional O.A.S.I. benefits.

Some 36 per cent of dentists die between 72 and 94 years of age; at 72, benefits are paid without regard to income. Dentists now covered by O.A.S.I. are those employed by other dentists and by government, industry, the military and organizations like the American Dental Association. What makes these O.A.S.I.-covered dentists different from those of us who are self-employed is hard for me to understand.

The Hartford County (Conn.) Medical Society studied 144 obituaries and probate court cases of local physicians. One out of eight was in debt at the time of death; one of three left assets of less than $10,000. Only one died wealthy. The report, commented *Medical News Letter* (vol. 25, no. 12, 1955), "reveals some illuminating and startling facts which should make physicians do a bit of checking on their financial status." This is sound advice for dentists, too.

Some contend that the younger dentist is anti-O.A.S.I. The heavy majorities for O.A.S.I. in state-wide polls disprove their claim emphatically.

Nathan Kobrin, Brooklyn

Book Reviews

OCCUPATIONAL ORAL HEALTH IN GENERAL DENTISTRY AND PUBLIC HEALTH

Edited by Alfred J. Asgis, D.D.S., Ph.D. 60 pages with illustrations. No price listed. New York, First District Dental Society of the State of New York, 1954.

This book is a compilation of papers and discussions conducted by a public health workshop on dental care in industry. The major purpose of the workshop was to emphasize the responsibilities of the dental profession in the promotion of dental health of industrial workers. An additional objective was to direct the attention of industrial management and trade unions to their responsibilities in this area.

Some existing dental health programs in industry were analyzed by workshop participants. The advantage of an adequate industrial dental health program from the standpoint of increased production was brought out also.

Cost factors were not neglected in these discussions, although no definite conclusions were reached with regard to costs. As is customary with this type of meeting, a considerable number of resolutions were passed, which prompts this reviewer to paraphrase a well-known saying that "the road to hell is paved with good resolutions" or intentions.

F. C. Cady

THE YEARBOOK OF DENTISTRY (1954-55 YEAR BOOK SERIES)

Edited by Stanley D. Tylman, D.D.S.; Donald A. Keyes, D.D.S.; John W. Knutson, D.D.S.; Harold J. Noyes, D.D.S., M.D.; Hamilton B. G. Robinson, D.D.S., and Carl W. Waldron, M.D., D.D.S. 464 pages with 314 illustrations. Index. Price $6. Chicago, The Year Book Publishers, 1955.

The increasing number of articles that appear in dental literature on recent advances in dental science and dental technology presents a serious problem to the practicing dentist who wants to keep abreast of the times in his own area of interest and in the broader aspects of professional progress. Although abstracts of current literature appear in monthly periodicals, the practitioner finds it difficult to have direct access to information on a particular topic. The *Yearbook* is designed as a ready reference to supply that need.

The main sections in dentistry are given in the following order: oral pathology and oral medicine, operative dentistry, oral surgery, prosthetics, orthodontics and public health. The functional approach to clinical dentistry, of interest to the general reader, is not adhered to in the text. The approach used does not detract from the quality of the volume as a whole, however, especially as the opening section begins with a discussion of diagnosis.

The illustrations, the bibliography and the comments in various sections add to the educational value of the book. It is encouraging to note that oral diagnosis is not approached from a narrow viewpoint. Instead, pathologic processes are related to neoplastic, specific infectious, occupational, nutritional and general bodily conditions involved in diseases and disorders of the mouth.

Prevention in periodontics, orthodontics and other aspects of dental care are presented in different sections. Included are references to Selye's concept of alarm reaction in manifested mucosal oral-systemic lesions observed and treated by dentists. Consideration of these lesions in a section on oral medicine should prove helpful to the inquiring dentist. Helpful also are the references to ultrasonic cavity preparation and related technics covered in the section on operative dentistry.

Recent developments in dental research and in public health, which affect the practice of dentistry, are subjects with which the dentist is increasingly concerned. The reader will be better oriented by the overview of expanding dental public health presented in the section on this topic.

Charles F. Harper

ESTATE PLANNING FOR PHYSICIANS

By W. S. McClanahan, LL.B. 64 pages. Price not listed. Indianapolis, Research and Review Service, Inc., 1954.

Although this study was made to provide information on matters of particular interest to physicians, members of the dental profession will find it of equal interest and value. There has long been a belief that professional men have a special need for advice and guidance in financial affairs and in estate planning. Un-

like some professions and most businesses, the practice of dentistry gives the dentist little contact with the business world. Modern business is as technical and complex as is the practice of dentistry, involving as it does a knowledge of economics, finance, banking, insurance, law and taxes. But there has been developed in the past few years a new field of endeavor called estate planning.

The author, who is Trust Officer of the California Trust Company in Los Angeles, points out that there are four basic reasons why men save money: for emergencies, for disability, for old age and for death.

Treated first in the study is Estate Planning, and under this heading is considered the setting up of funds for emergencies, the purchase of life insurance, the making of a will, and the purchase of a home. Then consideration is given to taxes on estates, the marital deduction, coordinating tax planning, investments and property holdings, and possibly the setting up of a family trust.

The author recommends planning as retirement approaches instead of waiting until it is forced on one. Certainly as one reads this informative booklet, he cannot but be impressed with the need for advice on these matters. It is fortunate that there are available many trained full-time specialists who can assist the professional man in planning his affairs to meet today's complex problems. These men often are referred to as the estate planning team, which generally includes the lawyer, the life insurance underwriter, the trust officer and the accountant. The pamphlet was reproduced from the *Journal of the American Medical Association.*

R. M. Walls

THE PHARMACOLOGICAL BASIS OF THERAPEUTICS

By Louis S. Goodman, M.D., and Alfred Gilman, Ph.D. Second edition. 1,831 pages with illustrations. Index. Appendix. Price $17.50. New York, The Macmillan Co., 1955.

The first edition of Goodman and Gilman's book published in 1941, combined broad scope with readability of a high order. Because of the fine quality of the first edition, many persons interested in pharmacology and therapeutics have been looking forward to the appearance of a second edition.

The second edition is about 50 per cent larger than the first. The excellent organization has not been changed. The text itself has been completely revised, but it reads so smoothly the reader does not realize it is a revision.

It is divided into 18 sections. There are 304 pages devoted to central depressants, 280 pages to autonomic drugs and 340 pages to antiinfectives. Each of these sections would be a substantial book in itself. Other important classes of drugs, such as histamines and the antihistamines, hormones and their antagonists, and the vitamins are discussed at length. There is a special section on local anesthetics and a brief presentation of general principles of pharmacology and therapeutics. There are appendixes dealing with prescription writing and toxicology.

Those who have waited expectantly for this second edition will not be disappointed. It is an excellent correlation of pharmacology with therapeutics. It will be useful to any student, teacher or practitioner of dentistry.

Donald A. Wallace

EMOTIONS AND BODILY CHANGES

By Flanders Dunbar, M.D. Fourth edition. 1,192 pages and 2 charts. Index. Price $15. New York, Columbia University Press, 1954.

Part one of this well-known survey of psychosomatic literature is entitled "Orientation and Methodology." The author discusses changes in terminology, concepts, dissemination of knowledge, demand for service and areas of controversy. Of special interest is the author's point of view that the personality profile indicates the illness pattern to which a given personality may be particularly receptive. Specific emotional conflicts may shift the balance toward one or another symptom or group of symptoms within the pattern.

The greatly expanded second part, "Bones, Including Odontology," is of particular interest to the readers of THE JOURNAL in view of the developing interest of dentists in psychosomatic questions. It is significant, the author says, that there are several points in common between the psychiatrist and the dentist, including the fact that there are not enough dentists or psychiatrists to meet the need for care in their respective fields. Both, therefore, have to rely mainly on the hope of prevention.

The author reports several case histories and interesting correlations between decayed, missing or filled teeth and neurotic trends. The literature on psychogenic factors in gingivitis and bone tissue destruction is examined also. Particular emphasis is placed on the more specific psychological problems of the unconscious meaning of the mouth, the teeth and

tooth extraction, of bruxism, thumb sucking, tongue sucking, smoking and the various psychologically determined changes in the saliva.

The author discusses also some of the problems and the practical implications of psychodynamics not only from the point of view of the individual patient but in the patient-doctor relationship as well.

The last part of the book emphasizes the present need for a reorientation of the role of the psychiatrist in the diagnostic team, and of the extension, limits and goals of the general practitioner and of the specialist in dealing with the psychological factors of illness.

Luigi Tagliacozzo

ORAL HEALTH SURVEY OF TRISTAN DA CUNHA

By Reidar Fauske Sognnaes, D.D.S. 145 pages with 37 illustrations and 50 tabulations. Index. Oslo, Norway, Det Norske Videnskaps-Akademi, 1954.

Because Tristan da Cunha is famous for its inhabitants' good teeth, a dentist was included in the 13-man Norwegian scientific expedition which in 1937 visited this lonely volcanic island in the south Atlantic Ocean midway between South Africa and South America. During a four month stay, Dr. Sognnaes made an oral health survey of the 188 inhabitants.

The survey included clinical observations, examination of roentgenograms and plaster casts of the teeth and jaws, salivary analysis, various tests on the histological, physical and chemical properties of the teeth and observations on the composition of food and drinking water. The author's observations, together with many interesting details on the life of the inhabitants, are reported in this volume, number 24 in a series of reports on the results of the expedition.

Of particular interest to the dental scientist is the author's report (first set forth in 1941) that Tristan da Cunha is the only community on record in which food-borne dental fluorosis can be suggested. Although the drinking water of the inhabitants had a fluorine content (0.2 ppm) below the level generally considered conducive to mottling, mottling or white opaque spots were found with significant frequency on the teeth.

The diet of the islanders consisted mainly of fish and potatoes, the fish consumption being extraordinarily high (about four times greater than the average for Norway). Through their average daily fish intake, the Tristan people seem to obtain about seven times as much fluorine as they can through one liter of their drinking water and twice as much as would be obtained from drinking water containing 1 ppm of fluorine, the critical level for mottling of the enamel.

"The clinical evidence of a mild degree of mottling, the chemical evidence of an elevated fluorine content of the teeth and the unusually high consumption of fluorine rich food (in the absence of a high fluorine content of the water) suggest that a threshold degree of food-borne dental fluorosis exists in Tristan da Cunha," concludes the author. "Although this may be one of the factors which contributes to their relatively low caries incidence, one is probably not justified in concluding that the Tristanites are inherently resistant to dental disease."

N. C. Hudson

PSYCHOANALYTIC PRINCIPLES IN CASEWORK WITH CHILDREN

By Selma H. Fraiberg. 54 pages. Price 85c. New York, Family Service Association of America.

The three papers in this pamphlet were presented before a group of social workers and were published subsequently in the *Social Case Work Journal* and in *The Quarterly Journal of Child Behavior*. The author is an instructor at the Wayne University School of Social Work and in the Department of Psychiatry of Wayne University School of Medicine, Detroit.

Mrs. Fraiberg writes clearly and uses many examples to illustrate her material. The examples and her use of direct quotations not only enable the reader to get a clearer understanding of the material but also make the child and the author come alive for the reader.

In part 1 "Understanding the Child Client" will be of interest to any reader who works with children, professionally or as a parent. In the second article, "Counseling for Parents of the Very Young Child," Mrs. Fraiberg describes the work that was done to help the mother of Bobby, age 4 years and 10 months, who since early childhood had suffered with celiac disease.

The third paper is more technical in content. Case material is used as an illustrative device. Although all three papers were written for social caseworkers, other professional people who have children as their patients should find much which would be helpful in understanding children.

Ruth E. Allen

OPEN WIDER, PLEASE

By J. Stanley Clark. 391 pages with illustrations. Index. Price $5. Norman, Okla., University of Oklahoma Press, 1955.

In 391 pages, fortified with 21 illustrations and an interminable list of people and places, this book graphically portrays the development of dentistry in one of the nation's most rugged and romantic areas. On a coarse canvas composed of the Indian and the Oklahoma Territories, framed by the years from 1883 to 1955, the author paints the growth of the profession from the half dugout huts of the open plains to the skyscrapers of Tulsa and Oklahoma City.

His colorful dental montage is composed of many contrasts—contrasts between the problems of the early plains practitioner and those of his mid-twentieth century successor; contrasts between the life of the pioneer dentist's only auxiliary—his wife, carrying water from the tank car on the railway siding, and the life of her granddaughter struggling with a galaxy of electrical household appliances; contrasts between the dexterity of the picturesque itinerant street vendors who extracted teeth with their fingers and the skills of today's oral surgeons; contrasts between yesterday when anyone with a little deftness and much nerve could proclaim himself a dentist and today when he who would practice the profession must prove himself by rigid examinations.

There are but a few of the contrasts presented. There are countless others, each of which is of interest to all who are interested in the growth of their profession. Skillfully the author blends the progress of dentistry in Oklahoma with the developments in other occupations and shows the influence of each upon the other.

In the opinion of this reviewer, the title, *Open Wider, Please*, is ill chosen. A far better title—one based on a theme which runs throughout most of the volume—would have been *The Oklahoma Way*. But if the title does not do the book justice, the contents do as the material is well organized, skillfully written and expertly printed. Nor will the book require as much time in reading as its number of pages would indicate. Most readers will skip the endless paragraphs of names of practitioners and their places of practice. Such data are valuable for purposes of documentation but not for purposes of interesting reading. Obviously every Oklahoman dentist will want a copy of the story of dentistry in Oklahoma for his office and his private library, and so, too, will many dentists elsewhere.

CONCERNING CHRISTOPHER: FUN WITH A PARROT

By Dorothy L. Cutting. 42 pages. Price $2.50. New York, Exposition Press Inc., 1955.

Dorothy L. Cutting, the author, is a librarian at the Kansas City Western Dental College in Kansas City, Mo. Her book concerns, not dentistry, but a pet parrot named Christopher. This bright green, red and yellow creature has a personality of his own. He is jealous, demands attention, loves to eat and show off. His favorite game is shooting marbles. When food is in the making, Chris stays close to the cook reassuring her loudly that "Chris is a good boy." He likes salad dressing on his lettuce and jam on his toast.

Concerning Christopher will provide a half hour of enjoyable light reading for both adults and children in the dentist's waiting room.

D. Zabin

STERILISATION, DESINFEKTION UND HYGIENE IN DER ZAHNÄRZTLICHEN PRAXIS

By Ulrich Berger, Dr. med. 78 pages with 12 illustrations. Index. 7.20 DM. München, Urban & Schwarzenberg, 1954.

The author of this paper-backed booklet is now director of the Hamburg University dental clinic. In this study, which has been two years in preparation, Dr. Berger summarizes his observations of dental hygiene in clinical practice. Though sterilization is universally practiced, he contends that no one can be absolutely sure even in a well-regulated clinic that the sterilization process is completely effective.

The three sections of the volume deal with the sources of infection, the imperative need for complete sterilization and disinfection, and the types of agents and the methods now in common use. The author concludes that the autoclave in combination with other means is the most effective method of sterilization and that the original cost must not be a primary consideration in the selection of equipment. In the closing paragraphs, Dr. Berger appeals to the instrument manufacturers to make instruments that can undergo the necessary sterilization.

The illustrations show small autoclaves and other means of sterilization and disinfection available to dentists in ordinary practice. This work is above all practical and will make any reader sterilization-conscious.

G. Nichols

BIBLIOGRAFIA ODONTOLOGICA MEXICANA (MEXICAN DENTAL BIBLIOGRAPHY)

By Samuel Fastlicht. 220 pages with 40 illustrations. Index. Mexico City, La Prensa Médica Mexicana, 1954.

This work represents the first attempt to compile a complete bibliography of Mexican dental publications, including books, journals, pamphlets, regulations and theses published in the 400 year period from 1552 to 1952. The illustrations consist of facsimiles of interesting title pages.

Of special interest to historians of dental science are the descriptions of the sixteenth century documents, especially the *Codex Barberini* written by native Indians about medical and dental treatment practiced among their people. The rise of dentistry as a profession is evidenced in the publications and lists of practicing dentists from 1850 to the end of the century.

The earlier books and journals are described in detail; the later works, including 1,635 theses of the various universities in Mexico, are listed with brief comments. In a summary of previous foreign bibliographies, the author notes that no American dental works written in Spanish were included in Campbell's *A Dental Bibliography*, written in 1949.

Since the author is planning to publish a more complete bibliography as soon as practicable, he urgently requests that any information about works not included in his present bibliography be sent to him.

G. Nichols

GESCHWÜELSTE IM MUND-UND KIEFERBEREICH (TUMORS OF THE MOUTH AND JAWS)

By Prof. Dr. Gustav Korkhaus. Issue 15. 204 pages with 282 illustrations. Index. Munich, Carl Hanser, 1955.

This book contains a collection of 16 lectures delivered by the foremost men in Germany at the convention at Leipzig April 1953 on the topic "Tumors of the Mouth and Jaws." The lectures, though packed with scientific detail, will be enjoyed by those interested in the intricacies of the tumor problem. An outstanding feature are the 282 excellent illustrations. The legends are complete and concise.

The first seven lectures elaborate the basic questions of the science of tumors, the clinical picture of these growths and a revived discussion about the giant cell epulis.

The contribution of Dr. Heiss is excellent. One feels from his lecture the fine clinician and observer, who does not miss the smallest detail of the history of the patient, details so important for the diagnosis of some bone tumors. The presentation of the rare cavernous hemangioma in the mandible is interesting. This tumor usually is found in the liver.

Dr. Euler tries to smooth the dispute between Dr. Axhausen and Dr. Brosch. His critical studies confirm generally the view of Dr. Brosch, who maintains that any accumulation of granulation tissue may change into a giant cell tumor provided that vasculatory disturbances set in. These bleedings are of inflammatory origin and instrumental in the development of the giant cell epulis. Therefore, it is the task of the practitioner to look for the cause of the inflammation instead of applying radical surgery. The position of his opponent, Dr. Axhausen, is different yet prevalent in Germany. Dr. Axhausen considers these tumors partly as granulation growth and partly as real neoplasm. He explains the limitless multiplication of the cells as the result of failure of the body to "self-regulate." He sometimes demands drastic operations, which lead in the maxilla to total resection and in the mandible to mutilating resections.

Chapters include discussions on therapy, the significance of intubation anesthesia, well-known operation methods, the supporting appliances in maxilla tumors and prosthetic restorations when surgical reconstruction is inadvisable or impossible. Dr. Reichenbach calls attention to an operation for benign tumors of the mandible, first planned and executed by Dr. Axhausen. It is remarkable that a discussion of this method is missing in most of the textbooks, for its results are fine as the reviewer is able to confirm.

In this procedure a thick graft from the iliac crest is inserted under the skin of the mandible six weeks before the tumor is removed. Soft tissue covers the graft, and the nourishment of the transplanted bone is secured. After removal of the tumor, the graft is wedged into cuts made in the ends of the free bone stumps.

The presentation of Dr. Granzer on the treatment of tumors of the face is instructive. In the described treatment the wound, which is kept open, allows the roentgen rays to destroy directly the tumor rests and the content of the mixed tumors without damaging other tissue or skin.

The last speakers outline the basic science of radiation therapy, its indications and its technic.

Eugene Schorr

Current Literature

RESIDUAL METHYL METHACRYLATE IN THE DENTURE BASE AND ITS RELATION TO DENTURE SORE MOUTH

D. C. Smith and M. E. D. Bains. Brit. D.J. 98:55 Jan. 1955.

Polymerization of methyl methacrylate does not proceed to completion in spite of prolonged cure.

A procedure for the qualitative detection of the residual monomer which can be leached out by water has been deve'oped. The clean denture was immersed in distilled water for at least one hour. If, on addition of an equal volume of 0.001 N potassium permanganate to the water extract, a color change occurs as compared to a distilled water blank, the presence of monomer is indicated. Results of this test showed that the amount of monomer extracted, even on pronounced undercuring, was comparatively small and could be leached out from the material quite readily. Most of this water soluble monomer is likely to be washed out during finishing of the denture base.

Alteration of monomer content of the denture base with length of cure was determined by using a quantitative procedure for measuring monomer content. After curing for six hours at 212° F., the residual monomer content was 0.2 per cent as compared to 0.1 per cent on curing for 20 hours at 160° F. Specimens cured under these conditions gave a negative result with the permanganate tests, thus indicating the absence of extractable monomer. Apparently, after a certain length of cure, the residual monomer which was found quantitatively could not be leached out by water and thus was not detected qualitatively.

The total residual monomer can thus be divided into two parts, that washed out from the denture base by water or saliva in a comparatively short time, and the small amount present even after the longest cure, which does not appear accessible to leaching. Even if the latter part were made accessible under the mechanical stressing and leaching which occur in the mouth, the evidence is that it will be washed away equally rapidly.

If residual monomer were a cause of denture sore mouth, its irritant effects might be expected to appear rapidly, yet most of the instances of sore mouth occur many months after insertion of the denture. Application of the permanganate test to dentures of patients with sore mouths always yielded negative results for residual monomer. These facts, considered together with the small concentration of residual monomer in a normal denture and the rapidity with which this monomer, if accessible, can be leached out, lead to the conclusion that the probability of chemical irritation from residual monomer is small.

G. M. Brauer

EFFECTS OF THE ANTIHISTAMINE PYRROBUTAMINE ON SOFT TISSUE WOUND HEALING

Odus L. Baldridge, Jr. J. Oral Surg. 13:183 July 1955.

A method for the study of wound healing is offered in an attempt to determine the effects of an antihistamine on the healing rate of soft tissue. A standardized wound was inflicted on one flank each of a group of guinea pigs. These wounds were measured daily and the rate of healing was recorded. Two weeks later these same animals were wounded on the opposite flank after having received a preoperative dose of an antihistamine. In addition, an antihistamine was given postoperatively. These wounds also were measured daily, and their rate of healing recorded. Thus a control was established.

The results were subjected to a statistical analysis, and the following conclusions were drawn: (1) An injectable antihistamine, pyrrobutamine (Pyronil), produces a significant increase in the rate of wound healing. (2) There appears to be an optimum dose in the guinea pig for beneficial effects on wound healing. (3) Preoperative as well as postoperative administration of the antihistamine appears to be necessary to attain the maximum increase in the rate of wound healing.

CHEMICAL DETERMINATION OF HISTAMINE CONTENT OF HUMAN GINGIVA AND SALIVA

Samuel G. Sanders. J. Oral Surg. 13:193 July 1955.

Microchemical analyses of the histamine content of human gingiva and saliva under conditions of relative normalcy, antihistamine therapy, traumatic oral surgery and traumatic

oral surgery with accompanying antihistamine therapy were performed to provide some fundamental data in the consideration of the possible therapeutic value of antihistamines in oral surgery.

The following conclusions were drawn from this study: (1) Histamine is present in human gingival tissue in quantities similar to those found in skin. (2) Histamine is present in free human saliva in significant quantities without wide daily variations in the normal state. (3) The histamine level in free human saliva is depressed by administration of pyrrobutamine (Pyronil), an antihistamine. (5) The histamine level in expectorated human saliva after intraoral surgical procedures is significantly less in those patients receiving pyrrobutamine therapy. (6) Antihistamines seem to have definite value in the postoperative courses of certain patients who require oral surgical procedures.

Further investigation is needed regarding the choice of antihistamine agents, the dosage and the exact mechanism of the beneficial action or actions.

THE SAFETY OF ANESTHESIA IN THE DENTAL OFFICE

Harry M. Seldin and Benjamin S. Recant. J. Oral Surg. 13:199 July 1955.

The employment of any anesthetic agent is accompanied by the danger of possible loss of life. This danger exists when any anesthetic agent is administered, be it for medical, surgical or dental procedures. In order to determine the safety of the use of anesthetics in the dental office, a study was made of the Medical Examiner's Mortality Statistics relating to deaths in the dental offices in the City of New York during the ten year period, 1943 through 1952.

These statistics were compared with those of deaths resulting from anesthetics when the anesthesia was employed in hospitals or medical offices. Statistics were used from procedures of approximately similar severity and duration to those performed in the dental office and on those patients whom the dentist confronts in his daily practice. Otorhinolaryngological and minor ophthalmological procedures satisfied these conditions.

Of a total of 1,867 reported deaths from anesthetics in New York City during the years 1943 through 1952, only eight were attributed to dental office anesthesia. During this same period, 51 deaths resulted from anesthesia for tonsillectomy, and 15 deaths occurred during minor ophthalmological procedures.

The safety factor in the use of local anesthesia was greater than that of general anesthesia. Of the eight dental office deaths, six were due to general anesthesia. Only two were attributed to the use of local anesthetics, despite the fact that millions of local anesthetics were administered each year in dental offices. Deaths do occur with the use of local anesthetics, however, just as deaths have been reported accompanying the use of every anesthetic agent.

The safety of anesthesia in the dental office was shown to be increasing. During the last five years of the study period, there was only one fatality; none occurred during the last four years. This improved record was attributed to the increase in both the quality and quantity of the training in anesthesia for dentistry.

GARRE'S OSTEOMYELITIS OF THE MANDIBLE: REPORT OF CASE

Glenn J. Pell, William G. Shafer, G. Thaddeus Gregory, Ronald S. Ping and Lewis B. Spear. J. Oral Surg. 13:248 July 1955.

Garre's osteomyelitis is a lesion of bone characterized by focal gross thickening of the periosteum with peripheral reactive bone formation. The lesion results from a mild irritation or infection. It represents an atypical reaction of bone to a mild chronic osteomyelitis and characteristically occurs in individuals before the age of 25. It most frequently involves the anterior surface of the tibia and may or may not regress without surgical intervention. Because there is greater opportunity for infection to enter the maxilla and mandible than any other bone in the body, it is surprising that this type of sclerosing, nonsuppurative osteomyelitis has not been described more frequently in the dental literature.

An instance of a lesion of the mandible is described which is clinically, roentgenographically and histologically identical with Garre's osteomyelitis as it occurs in other bones of the skeleton. This condition probably occurs more frequently in the jaws than has been recognized.

AVULSION OF PERIPHERAL NERVES FOR TRIGEMINAL NEURALGIA: REPORT OF CASE

Charles C. Alling and Robert S. Van Alstine. J. Oral Surg. 13:252 July 1955.

A 71 year old woman was palliatively and conservatively treated for a major trigeminal

neuralgia, tic douloureux. The second and third divisions of the trigeminal nerve were involved with affections of the infraorbital and mental nerves.

After premedication with analgesics and a sedative, the mental and infraorbital nerves were avulsed by an intraoral approach. As an outpatient procedure under local anesthesia, incisions were made in the mucobuccal folds and the nerves exposed. By slow, firm traction the proximal nerve trunks were pulled out of the bony canals, and the peripheral segments entering the soft tissues were dissected free.

Radical, definitive treatment for trigeminal neuralgia consists of trigeminal rhizotomy or retrogasserian neurotomy. The radical treatment will effect a permanent relief in 94 per cent of the cases treated.

Avulsion of peripheral nerves gives temporary relief but is not a cure. The palliative approach is not advocated to replace the radical procedure or vice versa, but the two procedures should supplement each other.

The palliative procedure is indicated for patients who are poor surgical risks and in whom craniotomy would be hazardous, for instances of differential diagnosis between atypical facial neuralgia and a major trigeminal neuralgia and for patients who state that "had they comprehended the way facial anesthesia would be they would have not submitted to a trigeminal rhizotomy." This complaint is less apt to occur if a palliative procedure is instituted first and is followed by a craniotomy procedure if pain reoccurs.

Alcohol injections seem to be accompanied by intense pain, and there is a high percentage of unsuccessful attempts with an occasional, untoward complication of facial paralysis. By contrast, the avulsion technic is a precise, effective method of providing a longer period of relief than that obtained with injection of alcohol and is not attended with the danger of a craniotomy procedure.

CARDIAC RESUSCITATION

Seymour Alpert. J. Oral Surg. 13:108 April 1955.

Cardiac arrest and ventricular fibrillation occur about once in every 5,000 surgical procedures. It is imperative for the anesthesiologist to choose anesthetic agents judiciously, use them carefully, avoid anoxia at all times, be on the alert constantly for the development of cardiac arrest and recognize it promptly.

Anoxia, anesthetic agent idiosyncrasy, overdosage of anesthetic agents, reflex activity, preexisting heart disease and mechanical interference with heart action may each play a role in causing cardiac arrest.

The prompt recognition of cardiac arrest is of extreme importance as only three to four minutes are available for diagnosis and effective treatment of the patient for whom cardiac resuscitation is needed. After this time, permanent brain damage will result; and after six or eight minutes, a fatality may be anticipated.

As soon as the diagnosis is made, the anesthesiologist must maintain intermittent positive pressure oxygen insufflation. The surgeon must open the chest as quickly as possible in the fourth left interspace and begin cardiac massage immediately. In instances of ventricular fibrillation, cardiac massage is instituted at once, and electric shock is used to effect defibrillation.

The methods of oxygen therapy—the nasal catheter, mask and tent—and resuscitative measures—replacement of lost fluids, administration of circulatory stimulants and the maintenance of a patent airway—are reviewed.

REVIEW OF ANTIBIOTICS

William B. Deichmann. J. Oral Surg 13:214 July 1955.

The oral surgeon uses antibiotics for prophylaxis and for the treatment of infection. In the selection of an antibiotic, the surgeon is guided by his clinical experience, by recommendations from the bacteriological laboratory and by a combination of factors which will make one antibiotic more effective and more suitable than another for a particular patient.

Medication for "local" use is a misnomer, for the oral cavity (or the skin) offers not only an excellent opportunity for absorption but also for local and systemic sensitization, as well as for the growth of nonsusceptible organisms. An antibiotic should not be used for a minor cut or bruise; the use of a lozenge should be restricted to a patient in whom this type of medication is truly indicated.

A review of the currently used antibiotics is presented with emphasis placed on dosage forms, side effects and precautions for the effective use of these agents.

TRAUMATIC INJURIES OF THE TEMPOROMANDIBULAR JOINT

Roger G. Gerry. J. Oral Surg. 13:232 July 1955.

Fractures of the mandibular condyle may be classified as undisplaced, displaced but not dislocated and as fracture-dislocations. Undis-

placed condylar fractures do not require treatment beyond mandibular immobilization. Displaced fractures in which dislocation does not exist may be similarly managed as the condyle remains more or less in the glenoid fossa, and the length of the external pterygoid muscle is not noticeably reduced. In these instances, bilateral mastication should be accomplished easily after the fracture has healed.

In fracture dislocation the length of the external pterygoid muscle is greatly reduced, and the patient may not be able to masticate with the teeth on the side opposite a unilateral fracture-dislocation. For this reason open reduction of unilateral fracture-dislocations must be considered in the early treatment planning. If the dislocation is considerable and the blood supply is impaired, condylectomy should be considered. In bilateral fracture-dislocations, the deformity is similar on both sides and, therefore, open reduction or condylectomy is not necessary.

In any unilateral condylar injury, there sometimes may be limitation of condylar excursion and deviation toward the injured condyle during mandibular depression, with ultimate hypermotility and chronic dislocation of the opposite condyle. This postfracture condylar syndrome may be avoided by having the patient perform a tongue exercise which consists of depression of the mandible with the tip of the tongue pressed against the lingual surfaces of the maxillary molars on the side opposite the traumatized condyle.

EXTRACTION WOUND HEALING: CLINICAL OBSERVATIONS

W. Howard Davis, Adrian O. Hubbell, William E. Bogart and Van M. Graves. J. Oral Surg. 13:244 July 1955.

Three thousand lower molar extractions were studied to aid in the evaluation of oxytetracycline (Terramycin) cones and sulfa cones (5 grains sulfanilamide, 5 grains sulfathiazol) as a prophylaxis in the prevention of prolonged postoperative pain in the extraction wound.

No medication was used for one third of the wounds; these served as controls. In one third of the wounds, sulfa cones were used and oxytetracycline (Terramycin) cones were used for the final third.

The results were classified as normal and "complicated healing." Classified in the latter group were wounds whose objective appearance may have been normal but which were accompanied by pain after the third postoperative day. Only two instances of classical dry socket were observed (completely bare, septic, extremely painful and very slow healing.)

In the series in which sulfa cones were used, there was a decrease in wounds classified as "complicated healing" when compared with the control group. In completely impacted third molar wounds in which sulfa cones were used, there were 38 per cent fewer "complicated healing" sockets than in the control group.

Oxytetracycline cones showed a beneficial effect consistently. In completely impacted third molar wounds, there were 60 per cent fewer painful sockets than in the control group. No significant adverse reactions were noted to the sulfa or oxytetracycline, either systemically or locally.

OSTEOGENIC SARCOMA OF THE MANDIBLE: REPORT OF CASE

Charles A. Resch. J. Oral Surg. 13:254 July 1955.

A 48 year old woman came to the clinic because of an osteogenic sarcoma of the mandible. The tumor was first believed to be an osteoma because of the abundant amount of well formed bone. Approximately two months after surgical treatment the patient was seen because of a uniform, hard, painless enlargement of the anterior portion of the mandible between the mental foramens; the enlargement involved both labial and lingual surfaces.

An occlusal roentgenogram revealed increased sclerosis of the medullary portion of the anterior portion of the mandible with slight proliferation of the cortical layer. The pathologist's report was sclerosing osteosarcoma. Anterior resection of the mandible and subsequent total mandibulectomy were performed.

The patient survived only three years after initial surgical treatment. In view of the high malignancy of the osteogenic sarcomas, it is unlikely that even initial radical deforming surgery could have checked the growth of this sarcoma.

Deaths

Abraham, Clarence W., Indianapolis; School of Dentistry, Indiana University, 1925; died April 18; aged 55.

Ahnert, Herbert J., Wood, Wis.; Dental School, Marquette University, 1934; died April 21; aged 43.

Ainsworth, William L., Columbus, Ohio; College of Dental Surgery, University of Michigan, 1900; died March 11; aged 80.

Allinson, Sydney M., Milford, Conn.; School of Dentistry, University of Pittsburgh, 1933; died February 13; aged 45.

Andler, George J., St. Petersburg, Fla.; died April 1; aged 86.

Atwood, Ira O., Providence, R. I.; Dental School, Tufts College, 1905; died May 1; aged 71.

Avary, Hugh, San Diego; Atlanta Dental College, 1909; died March 27; aged 77.

Baumgarth, Henry, Chicago; Dental School, Northwestern University, 1902; died May 19; aged 75.

Baus, Erwin P., Milwaukee; Dental School, Marquette University, 1922; died May 26; aged 55.

Beattie, George E., Burlingame, Calif.; College of Physicians and Surgeons, San Francisco, 1911; died June 2; aged 71.

Beerman, Ernest A., Barrington, Ill.; Dental School, Northwestern University, 1910; died March 11; aged 69.

Beers, Ray C., Ticonderoga, N. Y.; School of Dentistry, Temple University, 1908; died March 24; aged 70.

Bethea, Guy D., Hattiesburg, Miss.; School of Dentistry, Tulane University, 1926; died April 6; aged 59.

Bielefeld, Herman L., New York; New York College of Dentistry, 1912; died May 8; aged 64.

Bilbrey, Dennis R., Washington, D. C.; School of Dentistry, Georgetown University, 1916; died March 23; aged 66.

Birchard, James A., Woodinville, Wash.; Dental School, Northwestern University, 1896; died March 4; aged 88.

Bishop, Charles E., Kirkersville, Ohio; College of Dentistry, Ohio Medical University, 1907; died March 13; aged 79.

Blankstein, Alan H., New York; School of Dental and Oral Surgery, Columbia University, 1926; died April 17; aged 51.

Blanton, Ben F., Sikeston, Mo.; Western Dental College, Kansas City, 1900; died March 23; aged 75.

Blunt, Charles L., Albert Lea, Minn.; College of Dental Surgery, University of Michigan, 1892; died March 4; aged 88.

Boswell, Moses C., Moberly, Mo.; died April 17; aged 86.

Boylhart, Wesley T., Smithtown, N. Y.; College of Dental and Oral Surgery, New York, 1921; died May 22; aged 59.

Boynton, Allan G., New York; College of Dental Surgery, University of Michigan, 1921; died April 16; aged 58.

Bramwell, Claudius E., Rexburg, Idaho; died March 18; aged 91.

Broad, Edward J., San Francisco; College of Dentistry, University of California, 1900; died February 12; aged 80.

Brown, James C., Detroit; School of Dentistry, University of Detroit, 1937; died April 4; aged 49.

Brumfield, Jacob M., Bogalusa, Wash.; School of Dentistry, Tulane University, 1910; died April 6; aged 70.

Brush, David C., Vineyard Haven, Mass.; Dental School, Tufts College, 1918; died March 5; aged 65.

Buehler, Edgar L., Stapleton, New York; Dental School, Harvard University, 1921; died May 12; aged 58.

Burchfield, Raymond L., East St. Louis, Ill.; School of Dentistry, Washington University, St. Louis, 1935; died April 27; aged 43.

Burke, Charles E., Bassett, Neb.; College of Dentistry, University of Nebraska, 1924; died February 25; aged 60.

Butter, James A., San Francisco; College of Physicians and Surgeons, San Francisco, 1944; died April 13; aged 38.

Canfield, James C., Lowell, Ind.; Indiana Dental College, 1905; died February 9; aged 72.

Canfield, John M. R., Wabash, Ind.; School of Dentistry, Indiana University, 1905; died April 28; aged 60.

Carlin, William P., Denver; died March 25; aged 51.

Carlson, Bertel G., Brookline, Mass.; Dental School, Tufts College, 1905; died March 4; aged 70.

Carroll, William P., Streator, Ill.; Dental School, Northwestern University, 1907; died February 23; aged 79.

Casey, Joseph H., Dorchester, Mass.; died October 6, 1954; aged 57.

Chessall, Ralph P., Berkeley, Calif.; College of Dentistry, University of California, 1917; died May 19; aged 61.

Chrt, George T., Berwyn, Ill.; Dental School, Northwestern University, 1921; died June 7; aged 55.

Cipala, George, Chicago; Chicago College of Dental Surgery, Loyola University, 1919; died July 14; aged 63.

Cole, Alvernus H., Butte, Mont.; College of Dentistry, University of Iowa, 1904; died April 17; aged 75.

Cole, Alvin O., Fostoria, Ohio; College of Dentistry, Ohio Medical University, 1906; died April 20; aged 73.

Colson, Lemuel, Starke, Fla.; Atlanta Dental College, 1906; died April 15; aged 81.

Compton, Luther F., Princeton, W. Va.; Baltimore College of Dental Surgery, 1915; died November 10, 1954; aged 65.

Cooper, William A., Cincinnati; Miami Dental College, Cincinnati, 1899; died April 15; aged 79.

Coxen, Orsa B., Indianapolis; Cincinnati College of Dental Surgery, 1899; died May 15; aged 76.

Crowder, Joseph D., Pittsburg, Kan.; Kansas City Dental College, 1918; died May 14; aged 70.

Cuden, Edward, Johnstown, Pa.; School of Dentistry, Temple University, 1931; died May 3; aged 46.

Cuthbertson, James B., Chicago; School of Dentistry, St. Louis University, 1919; died February 2; aged 58.

Davidson, Walter J., Chicago; Dental School, Northwestern University, 1917; died June 10; aged 62.

Dean, Harry W., Denver; Colorado College of Dental Surgery, 1905; died May 11; aged 75.

Denzler, John, Kearney, Neb.; College of Dentistry, University of Iowa, 1908; died April 11; aged 71.

Dickinson, John C., Trenton, N. J.; Medico-Chirurgical College of Philadelphia, 1915; died April 27; aged 65.

Dieffenbach, Arthur W., Westfield, N. Y.; School of Dentistry, University of Buffalo, 1903; died January 17; aged 73.

Di Pizzo, Daniel A., Elizabeth, N. J.; School of Dentistry, St. Louis University, 1954; died May 22; aged 25.

Ducote, Clifton G., Alexandria, La.; died April 8; aged 71.

Dunn, John F., Jr., Fall River, Mass.; Baltimore Dental College, 1909; died May 15; aged 69.

Emerson, Jesse D., Owensville, Ind.; died February 19; aged 81.

Ferro, Carmino C., Philadelphia; School of Dentistry, Temple University, 1926; died May 2; aged 53.

Flanders, Charles C., Malden, Mass.; Dental School, Tufts College, 1918; died May 25; aged 59.

Fleming, Thomas F., St. Louis; died October 28, 1954; aged 75.

Floyd, Frank L., Elmhurst, Ill.; Chicago College of Dental Surgery, Loyola University, 1926; died April 13; aged 59.

Forbes, Robert N., Allegany, N. Y.; College of Dentistry, University of Michigan, 1898; died March 26; aged 80.

Freeburg, Arnold A., Wichita, Kan.; Kansas City-Western Dental College, 1922; died April 16; aged 57.

Gilkinson, Albert W., New Philadelphia, Ohio; Baltimore College of Dental Surgery, University of Maryland, 1901; died April 16; aged 80.

Gill, Raymond E., Ridley Park, Pa.; School of Dentistry, Temple University, 1926; died May 15; aged 55.

Gillett, Roy C., Oskaloosa, Iowa; College of Dentistry, University of Iowa, 1918; died April 25; aged 63.

Sutton, Paul R., Los Banos, Calif.; College of Dentistry, University of California, 1925; died March 18; aged 54.

Talbott, Daniel F., Goodland, Ind.; School of Dentistry, Indiana University, 1930; died February 24; aged 48.

Thacker, Clive M., Floydada, Texas; College of Dentistry, Baylor University, 1921; died March 14; aged 57.

Vaile, Edward L., Des Moines, Iowa; College of Dentistry, University of Michigan, 1897; died December 7; aged 86.

Wagner, Louis P., Sheboygan, Wis.; Dental School, Northwestern University, 1889; died April 8; aged 87.

Wampler, George S., Union City, Ind.; Indiana Dental College, 1903; died February 9; aged 78.

Weber, Asbury A., Memphis, Tenn.; College of Dentistry, University of Tennessee, 1919; died January 31; aged 60.

West, Byron S., Syracuse, N. Y.; School of Dentistry, University of Buffalo, 1938; died February 9; aged 52.

Whitney, Herbert W., Mexico, N. Y.; School of Dentistry, University of Buffalo, 1901; died December 23; aged 81.

Wiesler, William H., Cedarburg, Wis.; Chicago College of Dental Surgery, Loyola University, 1890; died March 13; aged 89.

Wise, Charles A., Kalamazoo, Mich.; College of Dental Surgery, University of Michigan, 1899; died February 23; aged 79.

Directory

OFFICERS

Daniel F. Lynch, President.....1678 Primrose Road, N.W., Washington, D.C.
Bernerd C. Kingsbury, President-Elect.....490 Post St., San Francisco
Curtis A. Haggard, First Vice-President.....1202 Huntington Bldg., Miami, Fla.
Frederick W. Herbine, Second Vice-President.....230 N. Fifth St., Reading, Pa.
John E. Fauber, Third Vice-President.....Veterans Administration, Washington, D.C.
Harry Lyons, Speaker, House of Delegates...School of Dentistry, Medical College of Virginia, Richmond, Va.
Harold Hillenbrand, Secretary.....222 E. Superior St., Chicago
C. Willard Camalier, Assistant Secretary.....1726 Eye St., N.W., Washington, D.C.
Louis M. Cruttenden, Assistant Secretary.....222 E. Superior St., Chicago
H. B. Washburn, Treasurer.....Lowry Medical Arts Bldg., St. Paul
Lon W. Morrey, Editor.....222 E. Superior St., Chicago

BOARD OF TRUSTEES

John R. Abel, 1957, Thirteenth District.....405 N. Bedford Drive, Beverly Hills, Calif.
William R. Alstadt, 1957, Twelfth District.....610 Boyle Bldg., Little Rock, Ark.
Percy T. Phillips, 1957, Second District.....18 E. 48th St., New York
Clarence S. Renouard, 1957, Eleventh District.....304 Phoenix Bldg., Butte, Mont.
Howard B. Higgins, 1956, Fifth District.....Montgomery Bldg., Spartanburg, S.C.
L. H. Jacob, 1956, Eighth District.....Jefferson Bldg., Peoria, Ill.
Paul H. Jeserich, 1956, Ninth District.....School of Dentistry, University of Michigan, Ann Arbor, Mich.
Charles H. Patton, 1956, Third District.....235 S. 15th St., Philadelphia
Edward R. White, 1956, Fourth District.....921 Bergen Ave., Jersey City
Earl G. Jones, 1955, Seventh District.....185 E. State St., Columbus, Ohio
A. F. Schopper, 1955, Sixth District.....914 Professional Bldg., Kansas City, Mo.
Charles I. Taggart, 1955, First District.....139 Bank St., Burlington, Vt.
Lewis W. Thom, 1955, Tenth District.....1546 Medical Arts Bldg., Minneapolis

BUREAUS

Dental Health Education: Perry J. Sandell, Director, 222 E. Superior St., Chicago
Economic Research and Statistics: B. D. Moen, Director, 222 E. Superior St., Chicago
Library and Indexing Service: Donald A. Washburn, Director, 222 E. Superior St., Chicago
Public Information: Herbert B. Bain, Director, 222 E. Superior St., Chicago

COUNCILS

Constitution and Bylaws: F. A. Pierson, Chm., 1112 Federal Securities Bldg., Lincoln, Neb.
Dental Education: Philip E. Blackerby, Jr., Chm., W. K. Kellogg Foundation, Battle Creek, Mich.
Shailer Peterson, Secy., 222 E. Superior St., Chicago
Dental Health: David W. Brock, Chm., 6026 Enright Ave., St. Louis
R. H. Friedrich, Secy., 222 E. Superior St., Chicago
Dental Research: M. K. Hine, Chm., 1121 W. Michigan St., Indianapolis
H. Trendley Dean, Secy., 222 E. Superior St., Chicago

Dental Therapeutics: Lester W. Burket, Chm., 4001 Spruce St., Philadelphia
J. Roy Doty, Secy., 222 E. Superior St., Chicago

Dental Trade and Laboratory Relations: Walter E. Dundon, Chm., 111 N. Wabash Ave., Chicago
Bernard J. Beazley, Secy., 222 E. Superior St., Chicago

Federal Dental Services: F. J. Reichmann, Chm., Medical Arts Bldg., Oklahoma City, Okla.
Bernard J. Beazley, Secy., 222 E. Superior St., Chicago

Hospital Dental Service: Frank B. Hower, Chm., 814 Heyburn Bldg., Louisville, Ky.
Gerard J. Casey, Secy., 222 E. Superior St., Chicago

Insurance: J. S. Eilar, Chm., 7 Medical Arts Square, Albuquerque, N. Mex.
Paul W. Zillmann, Secy., 29 Walden Ave., Buffalo

International Relations: O. A. Oliver, Chm., 1915 Broadway, Nashville, Tenn.

Journalism: W. L. Barnum, Chm., Morgan Bldg., Portland, Ore.

Judicial: H. B. McCarthy, Chm., College of Dentistry, Baylor University, Dallas, Texas

Legislation: Paul E. Jones, Chm., 3 E. Church St., Farmville, N.C.
Bernard J. Conway, Secy., 222 E. Superior St., Chicago

Membership: J. R. Wallace, Chm., 31 Church St., Winchester, Mass.

National Board of Dental Examiners: Victor L. Steffel, Chm., 19 W. Fifth Ave., Columbus, Ohio
Gerard J. Casey, Secy., 222 E. Superior St., Chicago

Registry of Dental and Oral Pathology: Kurt H. Thoma, Chm., 1180 Beacon St., Brookline, Mass.

Relief: M. C. Hansen, Chm., 420 Seventh St., Racine, Wis.

Scientific Session: Charles S. Kurz, Chm., 550 N. Eighth St., Carlyle, Ill.

SECTION CHAIRMEN

Operative Dentistry: Arne F. Romnes, 55 E. Washington St., Chicago

Oral Surgery and Anesthesia: Samuel A. Brandon, 620 Medical Dental Bldg., Portland, Ore.

Orthodontics and Oral Development: William S. Brandhorst, 4952 Maryland Ave., St. Louis

Pedodontics: Maury Massler, 808 S. Wood St., Chicago

Periodontics: James P. Hollers, 4600 Broadway, San Antonio, Texas

Practice Administration: Hollis A. Askey, 715 Sharp Bldg., Lincoln, Neb.

Prosthodontics, Complete: W. Leslie Warburton, Medical Arts Bldg., Salt Lake City

Prosthodontics, Partial: Otto W. Silberhorn, 311 E. Chicago Ave., Chicago

Public Health Dentistry: George B. Clendenin, 4406 East West Highway, Bethesda, Md.

Research: David F. Mitchell, 3639 47th Ave., S., Minneapolis

Roentgenology: William E. Koch, Jr., 615 Metropolitan Bldg., St. Louis

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION
222 East Superior Street, Chicago 11, Illinois
WHitehall 4-6730

LON W. MORREY, *Editor* JOHN J. HOLLISTER, *Business Manager*

All expressions of opinion and all statements of supposed fact are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association. Articles are accepted with the understanding that they have not been published previously and that they are submitted solely to The Journal. The Journal of the American Dental Association is indexed in the Index to Dental Literature, in the Current List of Medical Literature and, in part, in the Quarterly Cumulative Index Medicus, Biological Abstracts and Chemical Abstracts.

Advertising copy must conform to the official standards established by the American Dental Association. Notice of change of address should be received one month before the change is to be effective. Orders for reprints of Journal articles must be received by the Business Manager's office not later than the 15th of the month of issue in order to secure advantage of the lowest possible prices. Orders received after this date are subject to special quotation.

Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Sixth Annual Session	Oct. 17-20, 1955	San Francisco
Ninety-Seventh Annual Session	Oct. 1-4, 1956	Atlantic City, N. J.
Ninety-Eighth Annual Session	Nov. 4-7, 1957	Miami, Fla.
Ninety-Ninth Annual Session	Nov. 10-13, 1958	Dallas, Texas
One-Hundredth Annual Session	Sept. 21-24, 1959	New York

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 14-16, 1956	Biloxi, Miss.	F. A. Finney, Jr.	1045 Forrest Ave., Gadsden
Alaska			J. L. Irby	Northward Bldg., Fairbanks
Arizona	Apr. 11-14, 1956	Tucson	R. W. Christensen	17 E. Weldon Ave., Phoenix
Arkansas	Apr. 8-11, 1956	Little Rock	D. M. Hamm	Box 89, Clarksville
California	Apr. 23-25, 1956	San Francisco	W. J. Healy	450 Sutter St., San Francisco
S. California			J. P. Bowers	124 W. Lime Ave., Monrovia
Colorado	Oct. 2-5	Colorado Springs	W. R. Humphrey	724 Republic Bldg., Denver
Connecticut	May 2-4, 1956	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			R. V. Reed, Jr.	Medical Arts Bldg., Wilmington
District of Columbia	Mar. 11-14, 1956	Washington	J. F. Keaveny	1029 Vermont Ave., N.W., Washington
Florida	May 28-30, 1956	Miami Beach	W. A. Buhner	167 Broadway, Daytona Beach
Georgia	Oct. 2-5	Atlanta	J. W. Yarbrough	Bibb Bldg., Macon
Hawaii	Sept. 10-15	Maui Island	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	Sept. 27-29, 1956	Sun Valley	D. E. Sonius	125 Fourth Ave., N., Twin Falls
Illinois	May 14-17, 1956		P. W. Clopper	623 Jefferson Bldg., Peoria
Indiana	May 21-23, 1956	Indianapolis	D. C. Barnhill	409 Bankers Trust Bldg., Indianapolis
Iowa	May 6-9, 1956	Des Moines	H. I. Wilson	639 Insurance Exchange Bldg., Des Moines
Kansas	May 14-17, 1956	Topeka	F. A. Richmond	861 Brotherhood Bldg., Kansas City
Kentucky	Apr. 8-11, 1956	Louisville	A. B. Coxwell, Jr.	1976 Douglass Blvd., Louisville
Louisiana	Apr. 11-14, 1956	Alexandria	J. S. Bernhard	2315 Line Ave., Shreveport
Maine			S. M. Gower	Box 27, Skowhegan
Maryland	May 7-9, 1956		C. L. Inman, Jr.	Medical Arts Bldg., Baltimore
Massachusetts	May 6-9, 1956	Boston	H. E. Tingley	12 Bay State Rd., Boston
Michigan	Apr. 16-19, 1956	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Apr. 23-25, 1956	St. Paul	C. V. E. Cassel	225 Hamm Bldg., St. Paul
Mississippi	June 10-13, 1956	Biloxi	B. A. Cohen	306 Plaza Bldg., Jackson
Missouri	May 6-9, 1956	Jefferson City	E. D. Suggett	201 Merchants Bank Bldg., Jefferson City
Montana	May 3-6, 1956	Helena	E. G. Vedova	Box 311, Roundup
Nebraska	Apr. 30-May 3, 1956	Omaha	F. A. Pierson	1112 Federal Securities Bldg., Lincoln
Nevada			O. M. Seifert	306 Humboldt St., Reno
New Hampshire			F. E. Williams	814 Elm St., Manchester
New Jersey	Apr. 23-25, 1956	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico			J. S. Eilar	Medical Arts Square, Albuquerque
New York	May 14-16, 1956	Syracuse	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina	May 13-16, 1956	Pinehurst	R. D. Coffey	Box 270, Morganton
North Dakota	May 6-9, 1956	Minot	J. H. Pfister	419½ Dakota Ave., Wahpeton
Ohio	Nov. 13-16	Cleveland	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 22-25, 1956	Oklahoma City	S. A. Russman	809 Medical Arts Bldg., Oklahoma City
Oregon	Mar. 5-7, 1956	Portland	T. D. Holder	308 Selling Bldg., Portland
Panama Canal Zone			J. J. Dunn	5700 Dispensary, Albrook Air Force Base

State	Date	Place	Secretary	Address
Pennsylvania	Apr. 19-21, 1956	Harrisburg	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico			M. A. Rosso	409 Parque St., Santurce, San Juan
Rhode Island	Jan. 17, 18, 1956	Providence	W. D. MacIntosh	506 Industrial Bank Bldg., Providence
South Carolina			J. R. Owings	7 Medical Court, Greenville
South Dakota	May 13-16, 1956	Huron	L. N. Thelen	229 S. Prairie St., Sioux Falls
Tennessee	Apr. 30-May 3, 1956	Memphis	A. M. Ballentine	Pulaski
Texas	Apr. 29-May 2, 1956	Fort Worth	W. Ogle	3707 Gaston Ave., Dallas
Utah	May 17-19, 1956	Salt Lake City	R. C. Dalgleish	124 State Capitol Bldg., Salt Lake City
Vermont	May 20-22, 1956	Manchester	E. H. Van Santvoord	128 Merchants Row, Rutland
Virginia	May 9-12, 1956	Roanoke	W. T. McAfee	705 Colonial National Bank Bldg., Roanoke
Washington	Mar. 22-24, 1956	Seattle	W. B. Martin	Medical-Dental Bldg., Seattle
West Virginia			G. N. Casto, Jr.	710½ Lee St., Charleston
Wisconsin	Apr. 9-11, 1956	Milwaukee	A. E. Kopp	Wells Bldg., Milwaukee
Wyoming			T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama			W. L. McCarty	200 Professional Center, Montgomery
Alaska	Aug. 23*†	Anchorage	R. H. Williams	Box 2122, Juneau
Arizona			R. K. Trueblood	107 East A Ave., Glendale
Arkansas			H. O. Weatherly	205 Halter Bldg., Conway
California			T. E. Tilden	Medico-Dental Bldg., Sacramento
Colorado			J. M. Peabody	724 Republic Bldg., Denver
Connecticut			C. G. Brooks	302 State St., New London
Delaware			P. K. Musselman	143 W. Main St., Newark
District of Columbia	Jan 9-13, 1956	Washington	W. T. Birthright	Suite 718, 1835 Eye St., N.W., Washington
Florida			A. W. Kellner	P. O. Box 155, Hollywood
Georgia			P. M. McNeil	307 First National Bank Bldg., Rome
Hawaii	Sept. 1, 2, 4, 5*†‡		H. L. Houvener	427 Dillingham Bldg., Honolulu
Idaho			A. G. DeWinter	Sun Bldg., Boise
Illinois			W. A. McKee	503 Wood Bldg., Benton
Indiana	Nov. 14-17*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	May 28-June 1, 1956*†	Iowa City	P. A. Hahn	302 Farmers & Merchants Bank Bldg., Burlington
Kansas			G. L. Teall	Box 71, Hiawatha
Kentucky			J. J. Kelly	Franklin
Louisiana			R. C. Steib	833 Maison Blanche Bldg., New Orleans
Maine			R. A. Derbyshire	Box 387, Skowhegan
Maryland	Nov. 14-16‡		H. Levin	3429 Park Heights Ave., Baltimore
Massachusetts			G. J. Fink	Rm. 33, State House, Boston
Michigan	Jan 29-Feb. 4, 1956 June 10-16, 1956	Ann Arbor	J. L. Champagne	3714 W. McNichols Rd., Detroit
Minnesota	Jan. 9-13, 1956‡ June 11-15, 1956‡		M. G. Walls	615 Montcalm Place, St. Paul
Mississippi	Jan. 3-7, 1956‡ June 19-21 1956‡		J. C. Boswell	508 Lamar Life Bldg., Jackson
Missouri			R. H. Rhoades	414 Central Trust Bldg., Jefferson City
Montana			R. O. Betzner	303 Power Block, Helena
Nebraska	June 11-16, 1956	Lincoln	H. E. Weber	1210 Federal Securities Bldg., Lincoln
Nevada			R. Whitehead	Suite 6, Masonic Temple, Reno
New Hampshire			S. G. Markos	8 Renaud Ave., Dover

State	Date	Place	Secretary	Address
New Jersey			W. A. Wilson	150 E. State St., Trenton
New Mexico			J. J. Clarke, Sr.	Artesia
New York			D. W. Beier	23 S. Pearl St., Albany
North Carolina			F. O. Alford	1107 Liberty Life Bldg., Charlotte
North Dakota	July 9-13, 1956	Fargo	T. M. Flath	Williston
Ohio			H. B. Smith	322 E. State St., Columbus
Oklahoma			W. E. Cole	563 First National Bank Bldg., Oklahoma City
Oregon	Dec. 5-7*†	Portland	F. L. Utter	506 Pioneer Trust Bldg., Salem
Pennsylvania			A. M. Stinson	Dept. of Public Instruction, Box 911, Harrisburg
Puerto Rico			J. Mercado C.	Box 3717, Santurce
Rhode Island			F. M. Hackett	267 Academy Ave., Providence
South Carolina			J. L. Gunter	1226 Pickens St., Columbia
South Dakota			H. T. Aker	Canton
Tennessee			C. R. Aita	619 Bennie Dillon Bldg., Nashville
Texas	Sept. 28-Oct. 2* Sept. 30-Oct. 2†	Houston	R. T. Weber	312 Capital National Bank Bldg., Austin
Utah			D. L. Folsom	1101 First Security Bank Bldg. Salt Lake City
Vermont			P. M. Fitch	Newport
Virginia			J. M. Hughes	715 Medical Arts Bldg., Richmond
Washington			M. L. Mower	National Bank of Commerce Bldg., Olympia
West Virginia	June 25-27, 1956*†	West Liberty	J. B. Davis	501 Goff Bldg., Clarksburg
Wisconsin			S. F. Donovan	Tomah
Wyoming			W. A. Hocker	210 O & S Bldg., Casper

Most states require applications to be in 30 days prior to examination date.
*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations. §Approximate dates—verify with state dental examining board.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
American Academy of Dental Medicine	Dec. 4	New York	G. J. Witkin Secy.	45 S. Broadway, Yonkers, N. Y.
American Academy of Implant Dentures	Feb. 4, 1956	Chicago	P. S. Loechler Secy.	540 N. California, Stockton, Calif.
American Academy of Pedodontics	Oct. 12-14	San Francisco	E. C. Schildwachter Secy.	6831 Seville Ave., Huntington Park, Calif.
American Academy of Periodontology	Oct. 13-15	San Francisco	E. G. Baker Pub. Chm.	3400 Webster St., Oakland, Calif.
American Association of Dental Examiners	Oct. 14, 15	San Francisco	C. A. Bumstead Secy.	924 Stuart Bldg., Lincoln, Neb.
American Association of Public Health Dentists	Oct. 16	San Francisco	R. D. Smiley Secy.	Indiana State Board of Health, Indianapolis
American Board of Dental Public Health	Oct. 13, 14	San Francisco	P. E. Blackerby, Jr. Secy.	250 Champion St., Battle Creek, Mich.
American Board of Oral Pathology	Dec. 11	Washington, D.C.	D. A. Kerr Secy.	School of Dentistry, University of Michigan, Ann Arbor, Mich.
American Board of Pedodontics	Feb. 2-4, 1956	Ann Arbor, Mich.	R. L. Ireland Secy.	College of Dentistry, University of Nebraska, Lincoln, Neb.
American College of Dentists	Oct. 16	San Francisco	O. W. Brandhorst Secy.	4221 Lindell Blvd., St. Louis
American Dental Assistants Association	Oct. 17-20	San Francisco	M. L. Martin Exec. Secy.	410 First National Bank Bldg., La Porte, Ind.
American Dental Assistants Certification Board, Inc.	Oct. 16-20	San Francisco	A. Carey Secy.	601 National Bank Bldg., Lima, Ohio
American Dental Society Of Anesthesiology	Oct. 15, 16	San Francisco	J. H. Mervis Secy.	510 Walnut St., Clairton, Pa.
American Denture Society	Oct. 14, 15	San Francisco	A. L. Roberts Secy.	Aurora Main Bldg., Aurora, Ill.
American Institute of Dental Medicine	Oct. 23-27	Palm Springs, Calif.	M. G. Lewis Exec. Secy.	2240 Channing Way, Berkeley, Calif.
American Public Health Association	Nov. 14-18	Kansas City, Mo.	R. M. Atwater Exec. Secy.	1790 Broadway New York

Name	Date	Place	Secy. or Chm.	Address
American Society of Dentistry for Children	Oct. 15, 16	San Francisco	E. S. Mack	Stonestown Medical Bldg., 20th and Buckingham Way, San Francisco
American Society of Oral Surgeons	Oct. 11-14	Los Angeles	R. F. Whalen Exec. Secy.	M. C. V. Post Office, Box 876, Richmond, Va.
Asociacion Odontologica Argentina	Nov. 7-9		E. E. Muller Secy.	Junin 959, Buenos Aires, Argentina
Association of American Women Dentists	Oct. 16, 17	San Francisco	L. B. Thompson Secy.	1980 E. Center Ave., Denver
Austrian Dental Meeting	Sept. 1-4	Linz on the Danube, Austria	Prof. Hofer Secy.	Medical Association of Upper Austria, Dinghoferstrasse 4, Linz on the Danube, Austria
Chicago Dental Society	Feb. 5-8, 1956	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Council on Dental Education, Dental Aptitude Tests	Oct. 7, 8		S. Peterson Secy.	222 E. Superior St., Chicago
Denver Dental Association	Jan. 8-11, 1956	Denver	R. Kletzky Secy.	Republic Bldg., Denver
Eighth New Orleans Dental Conference	Oct. 30-Nov. 2	New Orleans	W. O. Goggin Chm.	Maison Blanche Bldg., New Orleans
Fourteenth Australian Dental Congress	Mar. 5-9, 1956	Melbourne, Australia	H. R. Cash Pres.	49 Mathoura Rd., Toorak, Australia
Fourtsenth Congres Francais de Stomatologie	Oct. 3-9	Paris, France	R. Vrasse Secy. Gen.	2, Rue de Miromesnil, Paris, France
Fourtsenth Congress of the Arpa Internationale	Sept. 5-11	Venice, Italy	A. J. Held Secy.	24, Rue Micheli-du-Crest, Geneva, Switzerland
Great Lakes Society of Orthodontists	Oct. 30-Nov. 2	Columbus, Ohio	H. I. Miller Secy.	1416 Mott Foundation Bldg., Flint, Mich.
Greater New York Dental Meeting	Dec. 5-9	New York	M. Purdy Exec. Secy.	Rm. 106A, Hotel Statler, New York
Greater Pittsburgh Dental Meeting	Nov. 8-10	Pittsburgh	H. D. Butts, Jr. Secy.	Suite 206 Jenkins Bldg., Pittsburgh
Journees Dentaires Internationales de Paris	Nov. 21-27	Paris, France	T. Dubois Secy. Gen.	Maison de la Chimie, 28 Bis Rue Saint-Dominique, Paris, France
Mexican Dental Association, Third Dental Congress	Oct. 23-28	Mexico City	G. Sanchez C.	Uruapan 3, Mexico, D. F.
Mid-Continent Dental Congress	Nov. 27-30	St. Louis	J. E. Brophy Exec. Secy.	8013 Maryland Ave., St. Louis
National Board of Dental Examiners	Dec. 5, 6		G. J. Casey Secy.	222 E. Superior St., Chicago
New England Dental Society	Nov. 2, 3	Boston	F. L. Finley, Jr. Secy.	43 Farmington Ave., Hartford, Conn.
Pan American Odontological Association	Dec. 7	New York	R. H. Brodsky Exec. Secy.	14 E. 81st St., New York
Pacific Coast Society of Prosthodontists	Oct. 14, 15	San Francisco	A. W. Spaulding Secy.	4350 11th Ave., Los Angeles
Pan-Pacific Dental Conference	Oct. 24, 25	Honolulu, Hawaii	F. A. Sandberg	280 Lewers Rd., Honolulu, Hawaii
Second Panhellenic Congress	Sept. 25-30	Athens, Greece	B. Stefanopoulos-Vrettos	71 Skoufa St., Athens, Greece
Southern Society of Orthodontists	Sept. 25-28	Charlotte, N. C.	M. D. Edwards Secy.	132 Adams Ave., Montgomery, Ala.
Southwestern Society of Orthodontists	Oct. 16-19	Wichita, Kansas	H. S. Born Secy.	908 Johnstone, Bartlesville, Okla.
Thirtieth Italian Congress of Stomatology	Sept. 12-17	Naples, Italy	L. Benedetti Chm.	Associazione Medici Dentisti Italiani, 44, Via Salaria, Rome, Italy

INDEX TO ADVERTISEMENTS

September 1955

Abbott Laboratories A-64, A-65
American Dental Association
Annual Session A-14
Dental Abstracts A-35
Dental Aptitude A-52, A-53
Hotel Reservation Application..A-20, A-21
National Board Examinations.....A-28
American Ferment Co., Inc.....A-36
Amurol Products Co.....A-72, A-7
Ash, Sons & Co., Claudius.....A-48
Astra Pharmaceutical Products, Inc....Insert
Austenal Laboratories, Inc...A-58, A-59, A-73

Baker & Co., Inc.....A-74
Blakiston Division,
McGraw-Hill Book Co., Inc.....A-38
Bowen & Co., Inc.....A-33
Bristol-Myers Co. .....3rd Cover

Castle Co., Wilmot.....A-41
Caulk Co., L. D.....A-62, A-11
Certified Products, Inc.....A-44
Church & Dwight Co., Inc.....A-54
Classified Advertising A-42, A-43, A-44
Coe Laboratories, Inc.....A-55
Columbia Dentoform Corp.....A-66
Columbus Dental Mfg. Co.....A-67
Colwell Publishing Co.....A-25
Cook-Waite Laboratories, Inc.....A-46, A-47
Crescent Dental Mfg. Co.....A-6

Dental Bur Holder Mfg. Co.....A-38
Dental Perfection Co.....A-60
Dentists' Supply Co., of
New York, The.....4th Cover
Du Pont de Nemours & Co., Inc., E. I...A-39

Exakta Camera Co.....A-38

Gesner, Inc., M. A. A-32
Great-West Life Assurance Co.....A-18

Halekulani Hotel A-25
Hamilton Manufacturing Co.....A-76
Hammond Organ A-66

International Nickel Co., Inc., The.....A-31
Invincible Metal Furniture Co.....A-25

Jectron Co. A-22
Jelenko & Co., J. F. A-1
Johnson & Johnson.....A-16, A-72
Justi & Son, Inc., H. D. A-66

Kerr Manufacturing Co.....A-30

Lactona, Inc. A-13
Lauer Metal Shop.....A-44
Lederle Laboratories A-63

Midwest Dental Mfg. Co.....A-57
Mizzy, Inc. A-12

Ney Co., The J. M. A-49
Novocol Chemical Mfg. Co., Inc.....A-29
Nobilium Products, Inc.....A-45

Odontographic Mfg. Co.....A-50
Oral B Co.....A-34

Pelton & Crane Co.....A-56
Permadent Products A-24
Pfingst & Co., Inc.....A-33, A-75
Physicians Casualty & Health Assn. A-7
Professional Budget Plan.....A-15
Pycope, Inc. A-23

Ransom & Randolph Co.....A-51
Reserve Plan, Inc.....A-5
Rinn X-Ray Products, Inc.....A-68
Ritter Co., Inc.....2nd Cover
Rower Dental Mfg. Co.....A-71

Saunders Co., W. B. A-26, A-27
Shelly Dental Mfg. Co.....A-69
Squibb & Sons, E. R., Division of
Mathieson Chemical Corp.....A-37
Surgident, Ltd. A-74

Ticonium A-19, A-4

United Air Lines.....A-70
U. S. Air Force.....A-61

Wernet Dental Mfg. Co., Inc.....A-8, A-9
White Dental Mfg. Co., The S. S....A-2, A-3
Wyeth Laboratories A-10
Williams Gold Refining Co., Inc.....A-40

Can you spare a minute, Doctor?

Are you taking advantage of the low cost life insurance available under the A.D.A. Group Plan?

This plan, underwritten by Great-West Life, is especially designed to give A.D.A. members under age 50 maximum protection at minimum cost. It provides essential life insurance protection through the expensive period of establishing a practice, and over the time of growing family responsibilities, increasing expenses and growing income.

The plan provides **$5,000** Basic Life Insurance Protection or **$10,000** for Accidental Death at an annual premium of

$21.00 to age 30

$26.50 from ages 31 - 40

$42.00 from ages 41 - 50

(After age 51 premium becomes 65.50 but does not increase thereafter. Instead, the amount of life insurance decreases annually from age 53.)

Conversion privileges and many additional advantages are available in this plan. For further details apply to:

DR. FRED A. RICHMOND, ADMINISTRATOR,
Group Life Insurance Plan, 861 Brotherhood Building,
Kansas City 1, Kansas.

THE

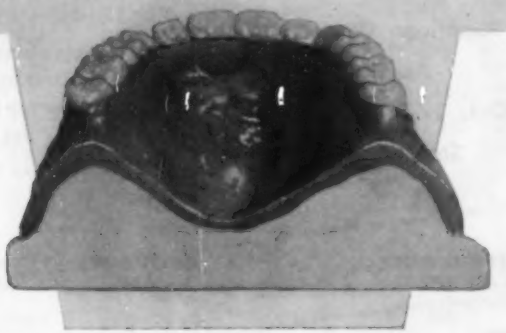
GREAT-WEST LIFE

ASSURANCE COMPANY

HEAD OFFICE - WINNIPEG, CANADA

OVER 12,000 A.D.A. MEMBERS NOW ENROLLED

Tilon IS CURED UNIDIRECTIONALLY



Fits perfectly. This test denture — like every Tilon denture — was dry-cured by modern, electrical, unidirectional curing for a perfect fit — every *time!*

TILON by TICONIUM
413 No. Pearl St., Albany 1, N. Y.

FIT
COLOR
STRENGTH

Hotel reservation application

96th Annual Session
American Dental Association
Oct. 17-20, 1955
San Francisco

INSTRUCTIONS: Reservations for hotel accommodations may be secured for San Francisco by completing this application and mailing it to: A.D.A. Housing Bureau, 61 Grove Street, San Francisco 2.

Be sure to indicate your arrival time in San Francisco. Reservations will be held only until 6 p.m. of the day you indicate when you will arrive in San Francisco unless special arrangements are made with the hotel.

Names of all persons who intend to occupy the accommodations must be listed on the application.

List four choices of hotels. Confirmation will be sent to the applicant indicating which hotel has accepted the reservation.

Write the A.D.A. Housing Bureau in San Francisco if you wish to cancel the reservation.

A.D.A. HOUSING BUREAU • 61 GROVE STREET, SAN FRANCISCO 2

(Please print or type) A.D.A.

Applicant:

Name _____

_____
(Street address) (City) (Zone) (State)

Arrival in San Francisco _____ a.m. / p.m. Leaving _____

Accommodations:

Hotel _____ (First choice) Hotel _____ (Third choice)

Hotel _____ (Second choice) Hotel _____ (Fourth choice)

☐ Single occupancy, rate to range from $_____ to $_____ per day.
☐ Double occupancy, double bed, rate to range from $_____ to $_____ per day. } 2 names must be listed below
☐ Double occupancy, twin beds, rate to range from $_____ to $_____ per day. }
☐ Suite of _____ rooms, including parlor, rate to range from $_____ to $_____ per day.

Occupants: (use an extra page for listing additional names if necessary)
Room will be occupied by:

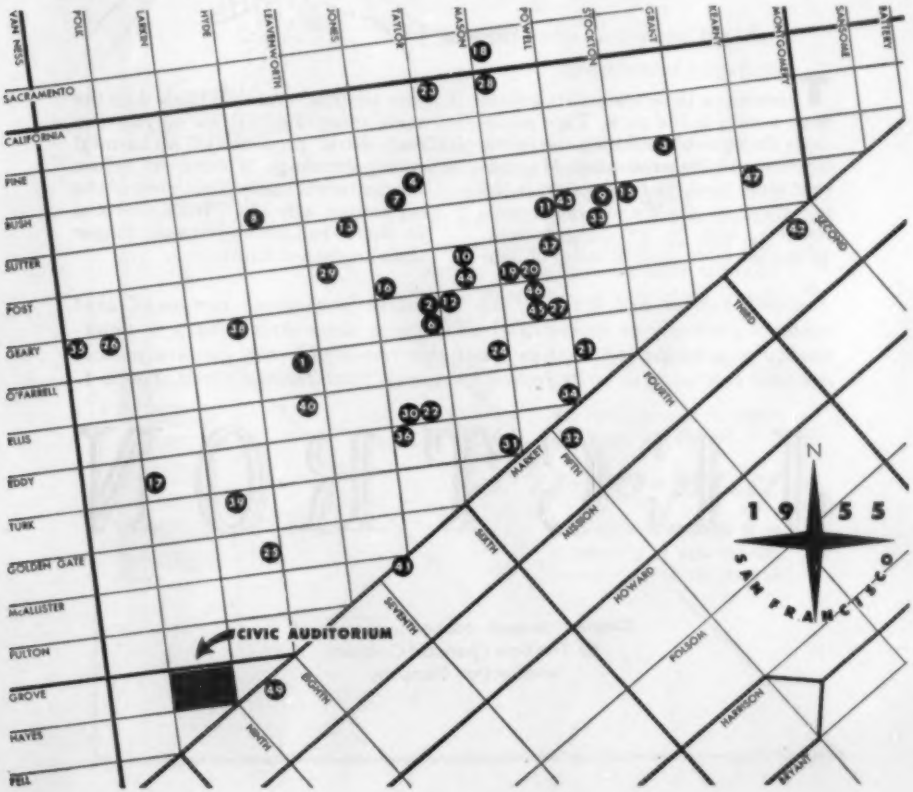
_____
(Name) (Address) (City) (State)

_____
(Name) (Address) (City) (State)

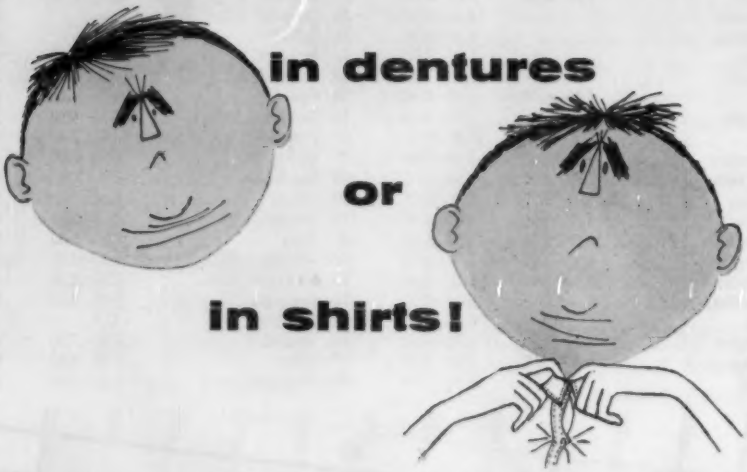
HOTELS IN SAN FRANCISCO

KEY NO.	HOTEL	SINGLE	DOUBLE
1	Alexander Hamilton	$6.50–10.50	$ 9.00–13.50
2	Bellevue		8.00–11.00
3	Beverly Plaza	6.00– 7.00	8.50– 9.00
4	Biltmore	5.00– 6.00	6.00– 8.00
6	Californian		8.00–10.00
7	Canterbury		6.00–10.00
8	Carlton		5.50– 6.00
9	Cartwright		6.00– 7.00
10	Cecil	4.00– 6.00	5.00– 8.00
11	Chancellor	5.50	7.50– 8.50
12	Clift	8.00–14.00	10.00–20.00
13	Commodore	4.00– 7.00	6.00–10.00
15	Drake Wiltshire	7.00– 8.00	7.50–10.00
16	El Cortez	5.00– 7.00	6.00–10.00
17	Embassy	4.00– 5.00	4.00– 7.00
18	Fairmont	10.50–16.00	13.50–19.00
19	Fielding	4.00– 7.00	5.00– 9.00
20	Franciscan	3.50– 5.00	5.00– 9.00
21	Golden State		5.00– 8.00
22	Herald		4.00– 6.00
23	Huntington	8.00–12.50	8.00–15.00
24	King George	4.00– 5.00	5.00– 8.00
25	LaSalle	5.00	6.00– 7.00

KEY NO.	HOTEL	SINGLE	DOUBLE
26	Lombard	$ 4.00– 6.00	$ 5.00– 9.00
27	Manx	5.50– 7.00	7.50– 9.50
28	Mark Hopkins	10.00–14.00	14.00–20.00
29	Maurice	5.00– 6.00	6.50– 8.00
30	Olympic		6.00–10.00
31	Oxford		6.00– 6.50
32	Pickwick	4.50– 5.50	6.00– 8.00
33	Plaza		7.00–10.00
34	Powell	3.50– 4.25	4.25– 6.50
35	Richelieu	4.00– 6.00	5.00– 9.00
36	Roosevelt	3.50– 5.00	4.50– 7.00
37	St. Francis	8.00–18.00	10.00–20.00
38	San Carlos		3.50– 5.00
39	Senate	4.00	5.00– 6.00
40	Senator	3.50– 3.75	4.00– 5.00
41	Shaw	4.00– 5.00	5.00– 6.50
42	Sheraton-Palace	8.00–13.00	10.00–17.00
43	Sir Francis Drake	8.50–14.50	10.50–19.50
44	Somerton	3.00– 4.00	4.00– 7.00
45	Spaulding	4.00	5.00– 6.00
46	Stewart	4.50– 7.00	6.00–12.00
47	Sutter	4.00– 5.50	6.00– 9.00
49	Whitcomb	5.00– 9.00	7.00–12.00



SHRINKING HURTS



There was a time when shirt collars were a pain in the neck. Then somebody thought of shrinking the fabric *before* the shirts were made. Magnificent idea. Now the fit of a shirt is the *last* thing to go. We are more comfortable, and we get longer wear. In the far more serious realm of denture adaptation, JECTRON does the same thing. JECTRON polystyrene resin also is "pre-shrunk." All harmful curing-shrinkage is removed before the denture is made. That's one of the big reasons why JECTRON dentures fit more comfortably years longer than any other kind!

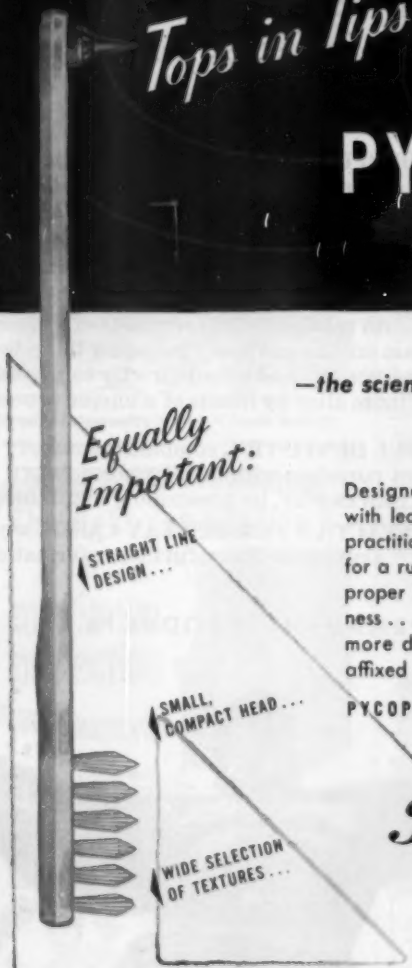
Jectron dentures are made of an exclusive polystyrene compound that contains positively no acrylic. Jectron dentures never shrink, warp or water-swell. For complete information about this remarkable new denture plastic, ask your laboratory or write Jectron Company, 1009 Jackson Street, Toledo 1.

JECTRON

Created through cooperative research
by The Dow Chemical Company
and Jectron Company.

Tops in Tips, Too

PY-CO-TIP



—the scientifically designed tip, for interdental hygiene

Equally Important:

Designed after intensive consultation with leading periodontists and general practitioners . . . and two years' research for a rubber of high quality to provide proper balance of flexibility and stiffness . . . Py-co-tip is preferred today by more dentists than any other brush-affixed stimulator.

PYCOPÉ, INC., JERSEY CITY 2, N. J.

For Py-co-tip and the brush of choice, specify . . .

Py-co-pay

TOOTHBRUSH

RECOMMENDED BY MORE DENTISTS THAN ANY OTHER TOOTHBRUSH

PERMANENT

strength

AND BEAUTY *IN*

PORCELAIN

PERMADENT-CERTIFIED porcelain bridgework has been PROVEN in thousands of cases through the years to sustain the promise of PERMANENCE and ESTHETICS with complete RELIABILITY.

THIS IS WHY we—and leading laboratories from coast to coast—bring it to the profession.

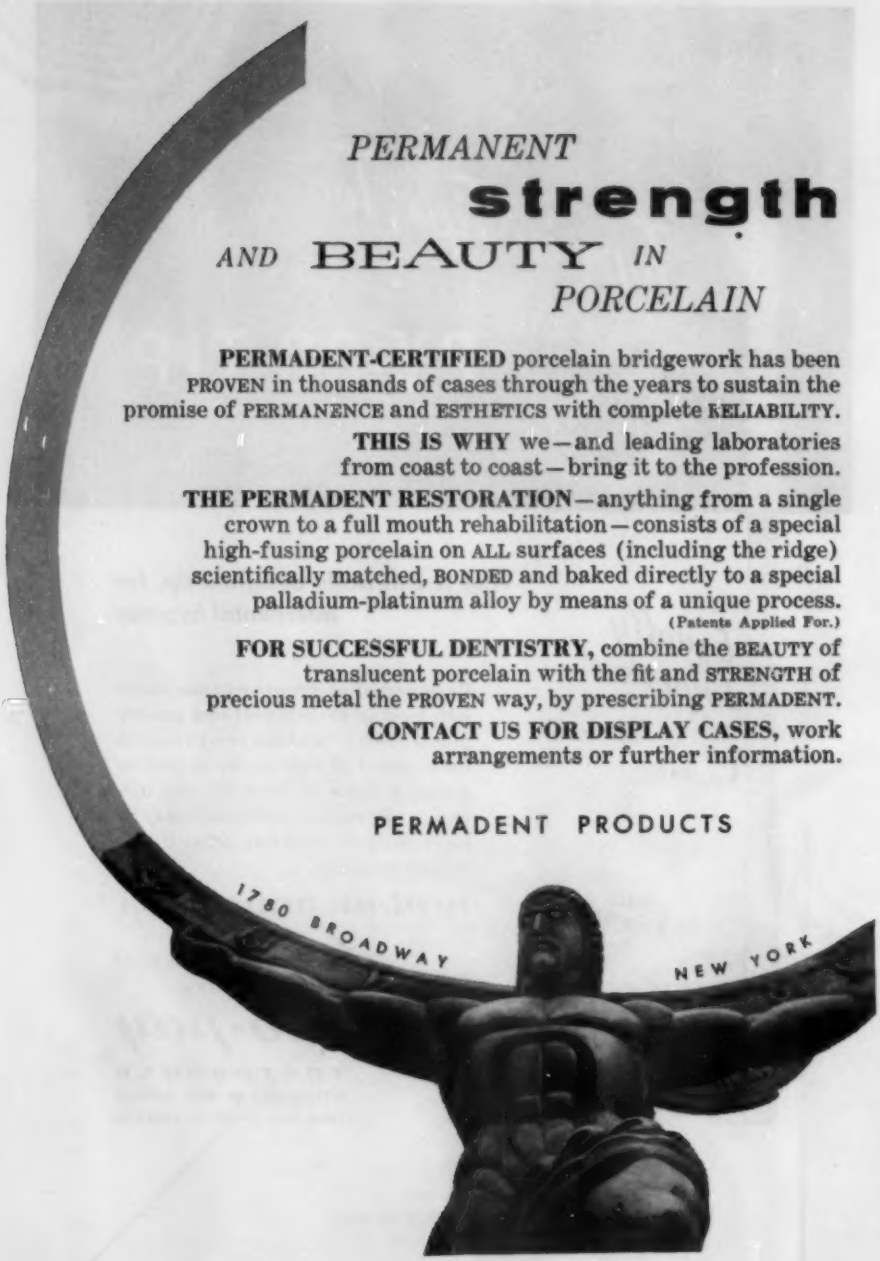
THE PERMADENT RESTORATION—anything from a single crown to a full mouth rehabilitation—consists of a special high-fusing porcelain on ALL surfaces (including the ridge) scientifically matched, BONDED and baked directly to a special palladium-platinum alloy by means of a unique process.
(Patents Applied For.)

FOR SUCCESSFUL DENTISTRY, combine the BEAUTY of translucent porcelain with the fit and STRENGTH of precious metal the PROVEN way, by prescribing PERMADENT.

CONTACT US FOR DISPLAY CASES, work arrangements or further information.

PERMADENT PRODUCTS

1780 BROADWAY NEW YORK



Halekulani Hotel

Next door to your convention headquarters

A few choice lanai suites still available

European Plan

See your travel agent or write:
HALEKULANI, HONOLULU
for folder

Owned and operated by the Kimball Family since 1917

The right combination for maximum protection

Valuable papers, confidential records, narcotics or dangerous drugs . . . they're all at your finger-tips, but perfectly concealed and safe from outside eyes and fingers. Yes, it's the exclusive Invincible Concealed Safe unit that provides convenient security PLUS the utility of an attractive, durable Invincible Filing Cabinet.

Choose the Invincible Concealed Safe Unit in either the desk-high, counter-high, or standard four-drawer filing cabinet. Choice of letter or legal size, with or without a general lock for file drawers.

Ask your office furniture dealer or write

INVINCIBLE®

INVINCIBLE METAL FURNITURE CO., Manitowoc, Wis.

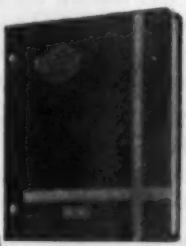
Now Ready for You! 1956 Daily Log

Record Book for Dentists

Your 1956 DAILY LOG for Dentists is off the press and ready for scheduling your new year's work. This complete one-volume financial record book assists in more efficient practice management—helps you avoid tax troubles—saves you time and money. Names of patients, services performed, amounts charged and cash received are all listed on DATED Daily Pages. All expenses itemized for easy tax reference. All record forms designed *specifically for your profession.* Now is the time to order your DAILY LOG—the most practical and easy-to-use bookkeeping system yet devised for your profession.

Price: $7.25 for CALENDAR YEAR

SATISFACTION GUARANTEED



MAIL COUPON TODAY!

Colwell Publishing Co.
262 University Ave.
Champaign, Illinois

☐ Please send me 1956 Daily Log for Dentists on approval. Remittance enclosed.

☐ Send more complete details along with FREE Record Supplies Catalog.

Dr.....

Address.....

City.....State.....

Dental Books

Thoma & Robinson's

ORAL and DENTAL DIAGNOSIS

with suggestions for treatment

New (4th) Edition!

A master-key to oral diagnosis. This *New (4th) Edition* is up-to-the-minute and vividly reflects today's concepts in techniques of examination, diagnosis and treatment-planning.

A working atlas of nearly 1000 illustrations, it shows virtually every conceivable dental lesion (the variables as well as the typical). Specific and pointed data are given on etiology, pathologic development and histologic changes—to help make your diagnoses more effective.

You will find detailed discussions on subjects like these: *X-ray Technique and Interpretation—Oral Rehabilitation—Selection of Type of Treatment—Patients with Disease States—Facial Deformities—Fractures of the Jaws—Neurologic Disturbances—Pain—Etc.*

The combination of Dr. Kurt Thoma and Dr. Hamilton Robinson brings great authority and a wealth of experience to this practical book. Scarcely a dentist will not welcome this helpful source of information on those diagnostic procedures most useful in daily practice.

By KURT H. THOMA, D.M.D., F.D.S.R.C.S., Eng., Hon. F.D.S.R.C.S. Edin., Professor of Oral Surgery, Emeritus, and Brackett Professor of Oral Pathology, Emeritus, Harvard University; Lecturer on Oral Surgery, The Graduate School of Medicine, University of Pennsylvania; and HAMILTON B. G. ROBINSON, D.D.S., M.S., associate Dean and Professor of Dentistry (Oral Pathology and Diagnosis), College of Dentistry, Ohio State University; Professor of Oral Pathology, College of Medicine, Ohio State University. 449 pages, 6" x 9", with 928 illustrations (55 in color). $10.50.
New (4th) Edition.

Order now with handy SAUNDERS form opposite ➡

From Saunders

Applegate's
PARTIAL DENTURE PROSTHESIS

A fresh new approach to your every problem connected with Removable Partial Dentures. Dr. Applegate gives you a complete exposition of the subject in a wonderful, illustrated question and answer style that makes learning simple and remembering easy. Here are the benefits you get: *1. Broad Understanding of Principles 2. Exactly How to Plan for Partial Dentures 3. Firm Grasp of Skilled Procedures in Design, Construction and Preparation of the Mouth 4. Full Understanding of the Relation of Removable Partial Dentures to Care of the Whole Mouth.*

By OLIVER C. APPLEGATE, D.D.S., D.D.Sc., F.A.C.D. Professor of Dentistry, School of Dentistry and W. K. Kellogg Foundation Institution: Graduate and Postgraduate Dentistry, University of Michigan. 323 pages, 8¼" x 11", 352 illustrations (10 in color). $10.00.

Skinner's
DENTAL MATERIALS

Every practicing dentist should have on his bookshelf a single up-to-date reference on all dental materials that he is ever likely to use or want to know about. In *Skinner* you get the SOURCE, COMPOSITION, PROPERTIES, COMPARATIVE MERITS, and WHERE AND HOW YOU WILL USE every conceivable dental material—materials like the new synthetic resins, hydrocolloid impression materials, chrome dental alloys, gypsum products, etc.

By EUGENE W. SKINNER, PH.D., Professor of Physics, Northwestern University Dental School. 420 pages, 6" x 9", 161 illustrations. $7.50. *Fourth Edition.*

Order now for 30 day free examination!

W. B. SAUNDERS COMPANY, West Washington Sq., Philadelphia

Send for 30-day examination and charge: ☐ Easy Payment Plan ($3.00 month)

☐ Thoma & Robinson's Oral Diagnosis.....$10.50
☐ Applegate's Partial Denture Prosthesis..... 10.00
☐ Skinner's Dental Materials..... 7.50

Name.....

Address.....

ADA 9-55

Announcing

National Board Examinations

December 5-6, 1955
(Applications should be received by Nov. 7, 1955)

April 2-3, 1956
(Applications should be received by March 1, 1956)

States and Agencies that recognize National Board Certificate

ALABAMA	NEW HAMPSHIRE
COLORADO	NORTH DAKOTA
CONNECTICUT	OKLAHOMA
ILLINOIS	OREGON
INDIANA	PENNSYLVANIA
IOWA	RHODE ISLAND
KANSAS	SOUTH DAKOTA
KENTUCKY	UTAH
LOUISIANA	VERMONT
MAINE	VIRGINIA
MARYLAND	WASHINGTON
MASSACHUSETTS	WEST VIRGINIA
MICHIGAN	U. S. PUBLIC HEALTH
MINNESOTA	U. S. ARMY
MISSOURI	U. S. NAVY
NEBRASKA	ALASKA
NEVADA	HAWAII

PUERTO RICO

Brochure describing the National Board Dental Examinations may be obtained by writing:

Council of the National Board of Dental Examiners
AMERICAN DENTAL ASSOCIATION
222 EAST SUPERIOR ST. -:- CHICAGO 11, ILLINOIS

your skill + unacaine HCl

3.8% WITH SUPRANOL 1:60,000

for success in mandibular anesthesia.

If you have ever experienced difficulty in obtaining complete mandibular anesthesia, the greater diffusibility, rapid action and added potency of UNACAINE HCL 3.8% will amaze you. Reference in the dental literature is made again and again to the difference UNACAINE HCL makes in inducing complete mandibular anesthesia where other local anesthetics have failed.

We quote from such a recent article "... Utilizing UNACAINE Hydrochloride in more than 1,000 cases involving crown and bridge prosthodontia the authors can definitely state that UNACAINE closely approaches the ideal anesthetic ... It was further noted, that in administering a mandibular block injection, the initial introduction of the solution was immediately effective, and a 'repeat' injection was rarely indicated." For success in mandibular anesthesia, your skill plus UNACAINE HCL are a sure combination!

UNACAINE offers all these qualities you seek in a local anesthetic—

- Almost instantaneous anesthesia
- 2½ to 5 times safer than procaine*
- Remarkably intense anesthesia
- Designed to cover average duration required for operative intervention
- Rapid, uneventful return to normal

*Subcutaneous white mouse determination, gauth for gauth. 5 times safer. Clinical concentrations, 70½ times safer. Intravenous injections show a Unacaine Toxicity comparable to that of procaine.

Novocol CHEMICAL MFG. CO., Inc.

2911-23 Atlantic Ave. Brooklyn 7, N. Y.

Toronto—London—Buenos Aires—Rio de Janeiro

Unacaine HCl and Supranol are the registered trade marks of the Novocol Chem. Mfg. Co., Inc., indicating its respective brands of metabutethamine HCl and natural epinephrine.

HERE

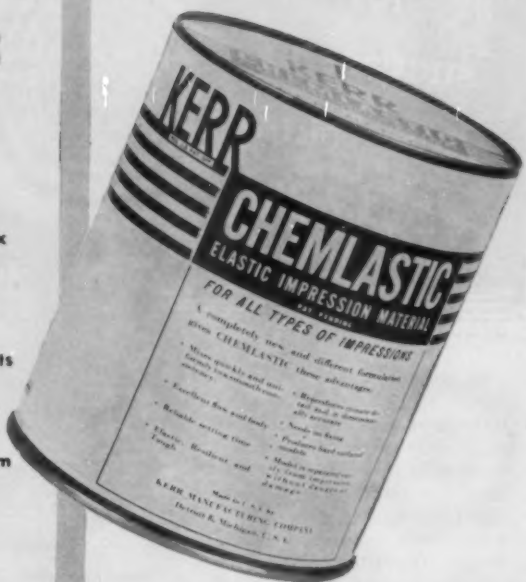
CHEMLASTIC

the Outstanding Alginate Elastic Impression Material

by KERR

The only Material which combines all these qualities—

- Accurate
- Body with flow
- Not critical
- Easy to mix
- Wets in 5 seconds
- Extremely smooth mix
- Appealing color
- Pleasant taste
- Tough
- Withdraws from erosions and undercuts
- No fixing
- Better model surfaces
- Not brittle
- Won't break teeth from models
- Cleans easily from tray and bowl
- Stable
- Uniform
- Each batch identical
- Economical



SUPERBLENDED! Chemlastic is pulverized and homogenized to produce a superfine, light, fluffy powder which gives you faster-mixing, uniformly-fine impression surfaces, matchless toughness, elasticity, and greater accuracy! You're in for a very rewarding experience when you try KERR Chemlastic. ORDER YOURS NOW!

KERR MANUFACTURING CO., DETROIT 8, MICHIGAN

KERR CHEMLASTIC
ELASTIC IMPRESSION MATERIAL

CONTENTS

		Page
Introduction		5
Part I.	The Requirements of Metals and Alloys for Dental Restorations	7
Part II.	Properties and Characteristics of Platinum-Palladium-Golds	9
Part III.	Casting Alloys of Platinum-Palladium-Gold	11
	Group I Alloys—For Bulky Inlays Subject to Slight Occlusal Stress	
	Group II Alloys—For Thin Castings Subject to Moderate Stress	
	Group III Alloys—For Highly Stressed Thin Castings and All Types of Cast Partial and Full Dentures	
Part IV.	Wrought Alloys of Platinum-Palladium-Gold	15
Part V.	Other Dental Materials of Platinum, Palladium, Iridium and Rhodium	16
Part VI.	Working Instructions for Casting Alloys	17
	Selection of Casting Alloys	
	Melting Procedure	
	Hardening and Softening by Heat Treatment	
	Investing and Casting Small Castings	
	Producing the Large Dental Casting	
Part VII.	Working Instructions for Wrought Wires	29
	Selection of Wrought Wires	
	Considerations in Hardening and Softening	
Part VIII.	Soldering Instructions	32
Part IX.	The Properties of Metals and Their Meaning to the Dentist	35
Bibliography		39
List of Manufacturers of Platinum-Palladium-Golds		40

Take a page out of our book, Doctor...

This page is the *Table of Contents* of "Platinum-Palladium-Gold in Dentistry." It tells what technical information you can expect from its 40 well-organized pages.

This reference work describes the properties and characteristics of dental alloys . . . their suitability for different types of prosthetic dentistry and orthodontia.

It also points up the mechanical properties of dental golds . . . gives their significance. Lists sources of supply.

Sound useful, doctor? It's free. Just send the coupon for your copy.

A-9

Platinum Metals Division
THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street, New York 5, N. Y.

Please send me my free copy of "Platinum-Palladium-Gold in Dentistry."

Name_____

Street_____

City_____

State_____

Platinum Metals Division

THE INTERNATIONAL NICKEL COMPANY, INC. *67 Wall Street, New York 5, N. Y.*

"It couldn't happen to me . . ."

Dr. D* . . . had to give up his practice when he was afflicted with dermatitis of both hands shortly after he purchased ADA insurance coverage. In your case, as in Dr. D's, office time represents your income. Respect it and insure it.

Take a moment, please . . . Think about protecting your income should disabling accident or illness keep you from your practice. ***Be prudent, too . . .*** See beforehand that your continuing income depends upon your presence in your office; that your absence may mean loss of financial security for you and your family. ***Think . . .*** have forethought and apply now for the economical and liberal income protection afforded by your American Dental Association Group Accident and Health Insurance Plan.

You save 35 to 50 per cent of the cost of similar protection individually purchased.

For complete information regarding benefits, regulations and semi-annual rates, communicate with the Trustee of the Policy, Dr. Paul Zillmann, 29 Walden Avenue, Buffalo 11, New York or with M. A. Gesner, Inc., 150 East Superior Street, Chicago 11, Illinois.

Issued Exclusively by
NATIONAL CASUALTY COMPANY of Detroit
Through
M. A. GESNER, INC.

150 East Superior Street **WHitehall 3-1525** **Chicago 11, Ill.**

Since the National Casualty Company's plan of accident and health insurance has been in effect for many years in New York, New Jersey, California, Utah and Nevada, the Association Plan is not available in those states.

DI-CET

Brand of Methyl Benzethonium Chloride

A LIQUID DISINFECTING AGENT IN POWDER FORM

FAST • ECONOMICAL • CONVENIENT

FOR POSITIVE DISINFECTION

DI-CET is a unique, thoroughly effective disinfecting powder concentrate. You merely add water to form an odorless, colorless, powerful disinfecting solution. . . .

DI-CET is supplied in foil packets for easy, safe storage. Each packet makes a full quart of DI-CET Disinfecting Solution. Anti-rust and water softener materials are also incorporated in the powder.

Accepted Council on Dental Therapeutics American Dental Association

FREE SAMPLE

A trial will demonstrate the great convenience, efficiency and economy of DI-CET. We'd like you to have a sample for that purpose. Fill-in coupon and mail to:

PFINGST & CO., INC. • 62 COOPER SQUARE • NEW YORK 3, N. Y.

DR. .....

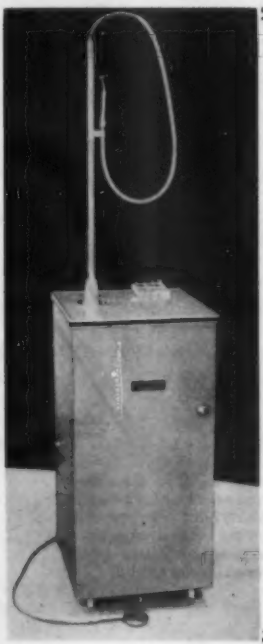
STREET .....

CITY ..... STATE .....

DEALER'S NAME .....

PFINGST & CO., INC. • 62 COOPER SQUARE • NEW YORK 3, N. Y.

BUSCH BURS • HORICO DIAMOND ABRASIVES • AJUSTO HAND PIECES • STAINLESS INSTRUMENTS



KERN

TURBO-JET

Patent Applied For

A Hydraulic Turbine Contra Angle Handpiece*

- **45,000 RPM**—for fast cutting
- **LOW TORQUE**—for safety
- **HYDRAULIC DRIVE**—no vibration
- **PLASTIC BEARINGS**—no lubrication
- **LIGHT CUTTING PRESSURE**—patient comfort

Self-contained unit—just plug it in
Contra Angle—no gears

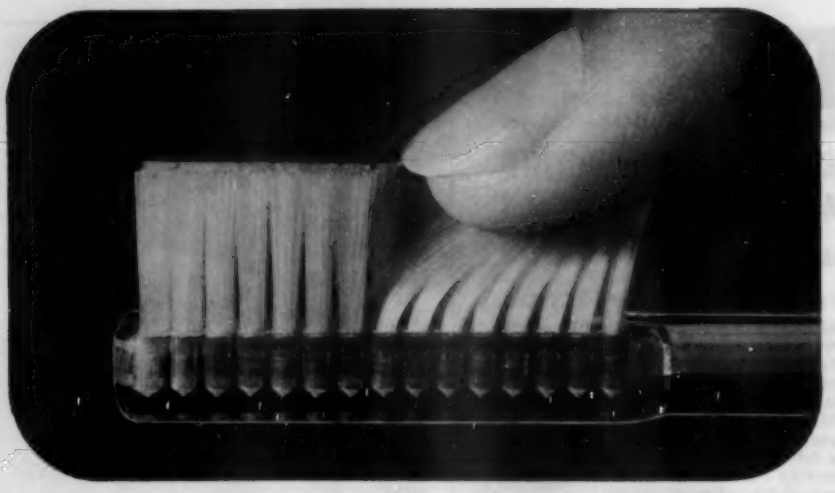
See it and try it at the San Francisco Meeting—Booth 522

Information may be obtained through your dealer or write direct to

BOWEN & COMPANY, INC.

P. O. Box 5816 Bethesda 14, Maryland

*JADA Vol. 47, P. 324-329, Sept. 1953. NELSEN, R. J., D.D.S.; PELANDER, C. E.; KUMPULA, J. W.: Hydraulic Turbine Contra Angle Handpiece. (Reprint on request)



We cordially invite you to

TEST IT YOURSELF

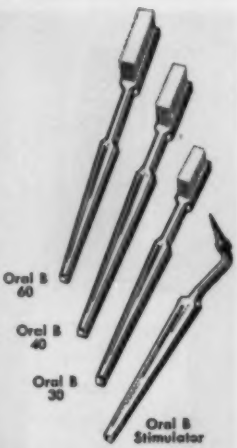
Professional men generally agree that, regardless of the dentifrice used, a toothbrush is the most important factor in maintaining good oral hygiene.

Since dentists are unquestionably the most qualified persons to select the proper type of brush, the wisest people take their advice on this matter. In this way the best brush is chosen to fit each patient's needs.

If you are unfamiliar with the Oral B Toothbrush, we suggest that you try it yourself. Then pass judgment on its effectiveness for use on both teeth and gums. The soft, flexible filaments are extremely small, with flat tops which minimize abrasion of tooth structure and injury to gingival tissue. In effect it becomes two brushes in one.

If you wish a complimentary brush, please mail a request on your professional letterhead.

First introduced in February, 1949



Oral B
TOOTHBRUSH

Write today for a supply of convenient prescription pads which have been prepared for the many doctors and hygienists who wish to prescribe the Oral B.

448 SOUTH MARKET ST. • SAN JOSE 13, CALIFORNIA

THE AMERICAN DENTAL ASSOCIATION

Announces a new publication

DENTAL ABSTRACTS

to be published monthly beginning January 1956 at the low annual subscription price of $6.00 for U. S. subscriptions; foreign $7.00.

DENTAL ABSTRACTS has a dual purpose: (1) to provide, by a few hours' reading each month, a survey of the significant advances being made by dentistry throughout the world, as reflected in current dental literature; and (2) to supply enough data in each abstract so that the reader may be encouraged to refer to the original article for more complete information.

DENTAL ABSTRACTS will enable every dentist to keep informed on dental progress everywhere. It will be particularly helpful to those—general practitioners, researchers, educators, technicians and manufacturers, to mention a few—who require a knowledge of more than one field in dentistry. All will find DENTAL ABSTRACTS the answer to a long felt need.

For easy reference DENTAL ABSTRACTS will be divided into these eight major sections:

Preventive and Public Health Dentistry
Basic Science
Periodontics and Endodontics
Operative Dentistry
Prosthetic Dentistry
Oral Surgery
Orthodontics
Professional Activities

The entire dental literature will be covered under these eight heads. So, be sure you're not disappointed! Send in your order and check today. The convenient order form below is for your use.

AMERICAN DENTAL ASSOCIATION, Subscription Dept.
222 East Superior Street, Chicago 11, Illinois

Please enter my subscription to DENTAL ABSTRACTS for 1 year. My check is enclosed.* I understand that the first issue will be January 1956.

please type or print

Name .....

Address .....

City, zone & state.....

*Subscriptions: $6 for U. S.; foreign $7.00.

Astring-o-sol mouthwash

concentrated for economy and convenience

a little goes a long way

- Here is a peppy, invigorating mouth rinse that not only tastes good and sweetens the breath, but also helps loosen and flush away organic debris.
- Astring-o-sol is an efficient detergent and effective deodorant. It will not injure delicate oral tissues and is ideal for daily mouth care.
- It's economical . . . it takes only a few drops of concentrated Astring-o-sol in a half-glass of water for a pleasing and effective mouthwash.
- USE IT AT THE CHAIR BEFORE AND AFTER DENTAL PROCEDURES
- RECOMMEND IT TO YOUR PATIENTS FOR DAILY MOUTH CARE

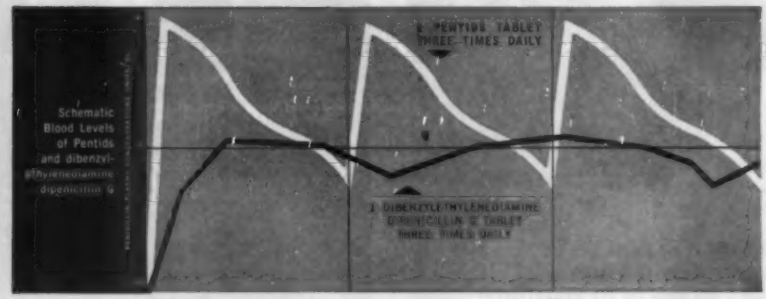
Remember... it takes only drops instead of drams because it's concentrated.

American Ferment Co., Inc.
1450 Broadway, New York 18, N. Y.

just 1 or 2 Pentids Tablets three times daily

as adjunctive therapy

for the more common dental infections


1 PENTIDS TABLET THREE TIMES DAILY
Schematic Blood Levels of Pentids and dibenzyl-ethylenediamine dipenicillin G
2 DIBENZYLETHYLENEDIAMINE DIPENICILLIN G TABLET THREE TIMES DAILY

Pentids are particularly effective as adjunctive therapy for acute oral Vincent's disease, pericoronitis, alveolitis, dento-alveolar abscess, cellulitis, and osteomyelitis. Also for prophylaxis before and after extraction and other dental surgery.

When pre-existing cardiac lesions predispose to sub-acute bacterial endocarditis or there is extensive tissue trauma, parenteral penicillin should be given before or at time of extraction followed by Pentids postoperatively.

PENTIDS

(Squibb 200,000 Units Penicillin G Potassium)

TABLETS

Dosage:
1 or 2 Pentids Tablets three times daily ½ hour before meals.

Supply:
Bottles of 12 and 100 tablets.

Also Available:
Pentids-Soluble Tablets, 200,000 units of soluble penicillin G.

CAPSULES—NEW! FOR CHILDREN

Dosage:
Contents of 1 or 2 Pentids Capsules three times daily ½ hour before meals.
Pentids Capsules are opened and their soluble penicillin is added to approximately 2 ounces of milk, fruit juice, ginger ale or similar vehicles.

Supply:
Bottles of 24 and 100 capsules.

SQUIBB

"PENTIDS"® IS A SQUIBB TRADEMARK

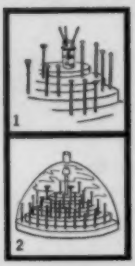
BUR-CAGE
DENTAL BUR HOLDER

protects from dust 'n rust!
speeds bur selection!
prolongs bur life!

TWO SIZES: 3⅞" 5⅞" diameter

BUR-CAGE IS IN DAILY USE BY LEADING DENTISTS & DENTAL CLINICS BECAUSE OF ITS VERSATILITY!

$6.00 3⅞" diam.



Under BUR-CAGE's protective plastic dome your burs are held upright for longer life and for instant selection.

GIVES NEW PROTECTION AGAINST RUST!

This attractive, compact unit features a unique container that facilitates elimination of rusting.

1. Simply drop Anti-Rust tablet into container and fill cup with alcohol.
2. When dome is on BUR-CAGE, all burs and accessories will be in constant dust-free, rust-free atmosphere . . . reassuring to both you and patient.

SPECIAL 10 DAY NO-RISK TRIAL OFFER!

Order **BUR-CAGE** today. Use it. Test it. If you're not completely delighted, return it. Otherwise send $7.50 for large size or $6.00 for small size ...plus postage. (Postage will be free if remittance is enclosed with order. Same return privilege.)

MAIL THIS COUPON TODAY!

Dental Bur Holder Manufacturing Co. J-55
49-01 69th Street Woodside 77, L.I., N.Y.

Gentlemen: I wish to take advantage of your FREE 10-DAY TRIAL OFFER. Please send me

_____ BUR-CAGE Bur Holder(s) in Color:

Black _____ Ivory _____

Sizes: 5⅞" @ $7.50 _____ 3⅞" @ $6.00 _____

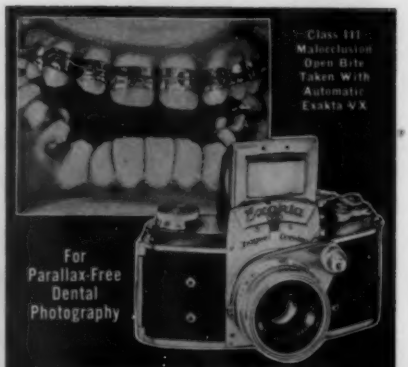
Within 10 days if I am not satisfied I may return the above, otherwise I will send the amount billed plus postage.

_____ I am enclosing my check to cover the order now and save postage. I understand I have the same return privilege.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



AUTOMATIC EXAKTA VX

35-mm. Single Lens Reflex Camera with f/2.0 Automatic Westagon Lens

For easily made dental photographs and faithfully reproduced oral conditions—facilitating case recording in oral pathology, surgery, orthodontics and full mouth rehabilitation . . . an invaluable aid in patient education. New AUTOMATIC Lens, when fully stopped down, permits focusing and viewing without annoying the patient with modeling lights. In addition, you can use the Exakta for personal photography, sports, portraits, copywork, etc.

FREE! — Write Dept. 200 for Free Descriptive Booklet "B" on Camera & Accessories and Brochure on Close-Up Technique with Automatic Exakta VX.

EXAKTA CAMERA COMPANY
705 Bronx River Rd., Bronxville 8, N. Y.

For your dental assistant
a remarkably helpful new book

BRAUER'S
THE DENTAL ASSISTANT

By John C. Brauer, D.D.S., A.B., M.Sc., F.A.C.D.
Dean of the School of Dentistry and Professor of Pedodontics, University of North Carolina

Written directly to the dental assistant by Dr. Brauer and 12 other contributors from the University of North Carolina Dental Faculty [who practice as well as teach dentistry] in cooperation with the American Dental Assistants Association. Covers every phase of knowledge your dental assistant needs to help her help *you* in your daily practice. 126 excellent illustrations clarify the text. Complete glossary of dental terms (a dental "dictionary" in itself). Order for your dental assistant today. 398 pages, 6x9.....$7.00

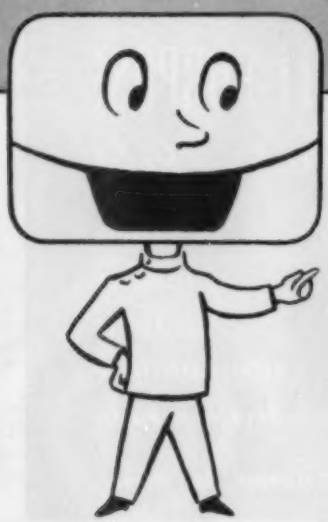
ORDER HERE

Blakiston Division, McGraw-Hill Book Co., Inc.
330 West 42nd St., New York 36, N. Y.
Please send me on 10-day approval
Brauer's THE DENTAL ASSISTANT.....$7.00

NAME .....
(Please Print)
ADDRESS .....
CITY..... ZONE.... STATE.....
DA 9-55

ANDY TAB SAYS . . .

"There are 4 Du Pont Films in the handy 'Pull-A-Tab' packet for your dental x-ray needs"



DU PONT "D" DENTAL FILM

A fast, double-coated, *all-purpose* periapical film. Its speed is useful where rapid exposures are necessary, yet it has sufficient latitude to stand over- and under-exposure.

DU PONT "S" DENTAL FILM

A medium-speed, single-coated film requiring about twice the exposure used with "D" Film. It offers finest detail.

DU PONT LIGHTNING FAST DENTAL FILM

A very high-speed periapical film. Its unusual speed permits increased focal distances while keeping exposures short. Cuts patient and operator exposure to radiation.

DU PONT NO. 3 BITEWING DENTAL FILM

A double-coated film with the same characteristics as Type "D" Dental Film, but designed for interproximal examinations. Comes in the handy "Pull-A-Tab" packet.

DU PONT DENTAL X-RAY PRODUCTS

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Mail this coupon for helpful free booklet "Du Pont Guide for Dental X-ray Darkrooms."

E. I. du Pont de Nemours & Co. (Inc.)
2496 Nemours Bldg.
Wilmington 98, Delaware

Please send me the free "Du Pont Guide for Dental X-ray Darkrooms."

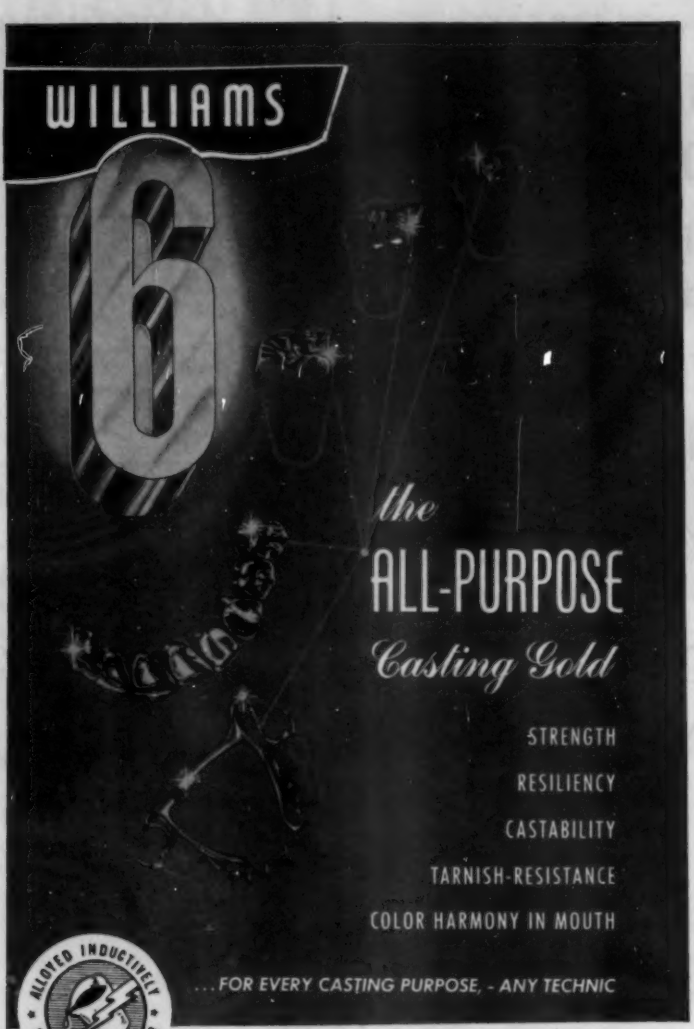
Name _____

Street _____

City _____

State _____

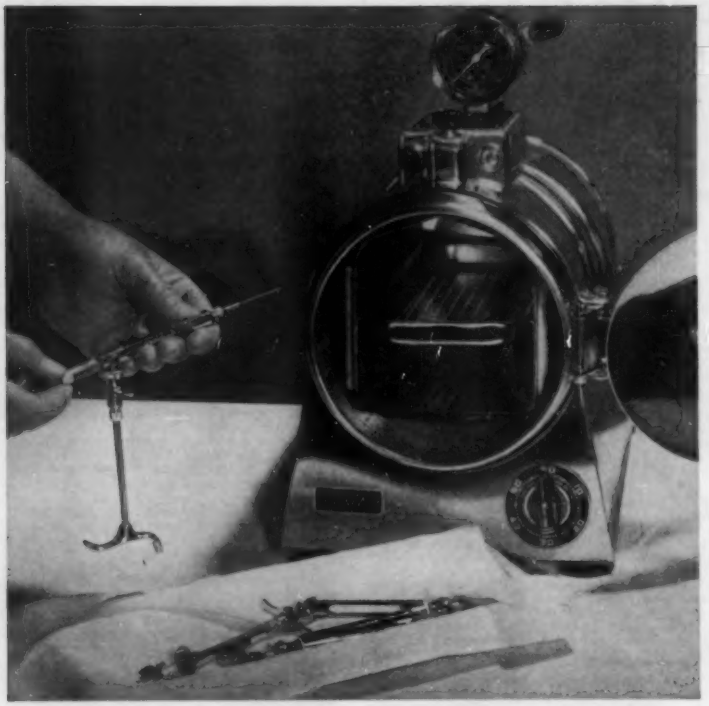
139



Economical? Let us prove it!
Send for new folder on Williams "6". Write to Dept. 40

WILLIAMS *Gold Refining Co., INC.*

FORT ERIE, ONT. BUFFALO 14, N. Y. HAVANA, CUBA



Would you let another Doctor use this needle on you?

Only when you see the needle come out of an autoclave would you give a positive *yes*.

You are cautious because you've seen the literature from Boston, New York, Rome, and Germany[1] that tells of cross-infection by improperly sterilized needles.

Unlike boiling, which only gets the easy ones, Speed-Clave sterilization kills spore-bearing bacilli—prevents the spread of infectious hepatitis . . . gives your practice sure protection against cross-infection.

And it's priced so you can afford it . . . only $216[2] for Castle's new "777" Speed-Clave!

This office autoclave is fully automatic, fast, compact and lightweight. Phone your Castle dealer for a demonstration . . . or write direct.

[1]*Bibliography on request*
[2]*and upwards to $219 according to zone*

Castle LIGHTS AND STERILIZERS

WILMOT CASTLE CO. • 1746 E. HENRIETTA RD. • ROCHESTER, N. Y.

CLASSIFIED ADVERTISING

Forms close on 25th of second month preceding month of issue

Remittance Must Accompany Classified Ads.

Classified advertising rates are as follows:
30 words or less—per insertion.....$4.00
Additional words, each..... .10
Answers sent c/o American Dental Association.....no extra charge

Replies to A.D.A. box number ads should be addressed as follows:
American Dental Association
222 E. Superior Street
Chicago 11, Ill. Box.....

Please be sure that the box number appears on the envelope.

PRACTICES AND OFFICES FOR SALE AND RENT

CALIFORNIA—Beverly Hills. For sale, complete, modern new dental office and established practice. Exceptional opportunity for young dentist. Owner leaving California permanently. Address A.D.A. Box No. 997.

●

CALIFORNIA—Southern California dental practice for sale. High class. More interested in proper successor than price. Terms practically your own. Wish to retire. Address A.D.A. Box No. 123.

●

CONNECTICUT—For sale. Good practice in an outstanding location, seacoast town. Exceptional opportunity. Must sacrifice as leaving to specialize. Address A.D.A. Box No. 131.

●

FLORIDA—Practice for sale. Beautifully equipped, two-chair, air-conditioned office in St. Petersburg. Excellent location. Established practice. Reasonable rent. Address A.D.A. Box No. 106.

●

FLORIDA—Miami Beach. For sale, completely equipped, modern, two-chair office. Air-conditioned elevator building. Finest central location, main street, Lincoln Rd. Available June 1956. Address A.D.A. Box No. 971.

●

ILLINOIS—For sale or rent. Completely equipped two-chair dental office and laboratory, including individual office building and parking facilities. Recent death of prominent local dentist leaves vacancy in Kankakee, Ill. Write or call Ada R. Kratz, 1340 Maple, Kankakee, Ill., or Ray M. Foreman, 708 Baum Bldg., Danville, Ill.

●

ILLINOIS—For sale, completely equipped office and practice. Small town in central Illinois, 100 miles south of Chicago, in rich farming area. Closed evenings, Saturday afternoons and Thursdays. Price $3,750 for quick sale. Step into a going practice immediately. Send your name and address on a postcard or send your business card in an envelope addressed to A.D.A. Box No. 129.

●

ILLINOIS—For sale. Orthodontic practice in Chicago. Established 30 years. Two-chair office with new equipment in Medical Arts Building. Terms convenient to purchaser. Will stay to introduce. Ill health reason for selling. Address A.D.A. Box No. 117.

●

INDIANA—Dental office, new, modern, completely equipped, consisting of waiting room, business office, two dental units, recovery room, laboratory, dark room and lavatory. Located in good neighborhood business district in South Bend. Available immediately due to disabling illness of former occupant. Write Max Feldman, M.D., 1921 Miami, South Bend, Ind.

●

INDIANA—Will rent or sell completely equipped modern, two-chair office with x-ray and laboratory. Northern Indiana lake region, drawing business from city of 150,000 population. Dentist deceased. Established practice. Should gross $15,000 or more first year. Mrs. Howard Egloff, R. R. 4, Columbia City, Ind.

MICHIGAN—For sale. Busy, well-established general practice, southwestern Michigan. Modern two-chair office. Grossing $20,000. Owner specializing. Address A.D.A. Box No. 966.

●

MINNESOTA—For sale. Excellent, established practice of young deceased dentist. Fully equipped, two-chair, air-conditioned, ground floor office, in prosperous southern Minnesota community. Splendid opportunity. Mrs. Frank Gayer, LeSueur, Minn.

●

NEW JERSEY—For rent, office, living quarters, garage. Choice location on doctors' row, reasonable rent, heat furnished. Presently occupied by optometrist. Write or call Dr. A. F. Senaldi, 106 Lexington Ave., Passaic, N. J. Phone Prescott 8-7037.

●

NEW YORK—Modern dental office for rent. Established 40 years. Excellent location. Large waiting room, office, laboratory and wash room. Wired for x-ray. Moderate rent. Write or telephone William Yalowich, 660 Hudson Ave., Rochester, N. Y. Telephone Ha 4380.

●

NORTH CAROLINA—For sale. Brick veneer bungalow office. Three operating rooms, equipped, ready for practice. Room for fourth chair or private office. In beautiful, scenic western North Carolina, near Asheville. Address A.D.A. Box No. 107.

●

PENNSYLVANIA—For sale. Dental office, fully equipped, combined with modern home, central, near Harrisburg. Deceased. Replacement urgently needed. Terms. Or will rent offices (4 rooms). Reasonable. Ready to begin practice. Mrs. Fay Mullen, 200 W. Main St., Mechanicsburg, Pa.

●

PENNSYLVANIA—For sale. Ranch type home-office. Waiting room, operating room, laboratory and powder room. Established 23 years. Former dentist deceased. Only dentist in community. Write Mrs. R. B. Tinsley, 3350 University Rd., Pittsburgh 35, Pa.

●

PENNSYLVANIA—For sale, two-chair dental offices. Lucrative practice. Suburban community, Lancaster county. Owner deceased. Fully equipped. Home attached. Financial help to proper applicant. Address Mrs. R. A. Ranck, Leacock, Pa.

●

PENNSYLVANIA—For rent, two-chair office, fully equipped. Can be rented with or without equipment. Three room apartment available in same building. Owner retiring. Dr. Clarence S. DeLong, 43 N. 11 St., Reading, Pa.

●

VIRGINIA—For sale. Beautifully equipped, two-chair, air-conditioned office in thriving resort community, 10 minutes from finest boating, fishing, hunting grounds in state, near Chesapeake Bay. Low rent. Attractive fees. Address A.D.A. Box No. 125.

WYOMING—For sale. Dental office and laboratory, fully equipped, like new. Located in rapidly growing Wyoming city. Oil and gas shipping center, uranium, 100,000 irrigated acres. Good fishing and hunting. Priced to sell. Dr. R. J. Inman, Box 846, Riverton, Wyo.

LOCATIONS AVAILABLE

MISSOURI—Opportunity. Space available for Missouri licensed dentist. Modern office building, occupied by two busy M.D.'s. Friendly town. Ample off street parking. Call or write Harold Miller, M.D., 600 Second St., Willow Springs, Mo.

•

NEW HAMPSHIRE—In prosperous and growing Hanover (Dartmouth College), modern dental clinic and residential building, 14 rooms, 1 bath, 2 lavatories, splendid location. Price $48,000. C. C. Hills, Realtor, Norwich, Vt.

•

NEW JERSEY—Fair Haven. For sale, beautiful new 11 room ranch house, occupied six months, situated on beautiful tree-lined street facing picturesque pond. Four bedrooms, 2½ baths, den, full basement, 2-car garage. Suitable for dentist or physician. Priced at $49,500. Address A.D.A. Box No. 116.

•

OHIO—Space for rent, suitable for dentist. Good location, ample parking space. Wadsworth, population 12,000. Need for additional dentist this community. Write Mrs. Ella Mae Ribar, R.N., 173 N. Lyman St., Wadsworth, Ohio.

•

PENNSYLVANIA—For sale. Office and home. Ideal for dentist. Delaware valley. No dentist in expanding residential town of 9,000, 25 miles north of Philadelphia. Contact Henry Haines, Realtor, Burlington, N.J.

•

SOUTH CAROLINA—Four modern treating rooms in lovely new two-story brick home. Town without dentist. Property built for own use. Bargain. Will sell. Easy terms to reliable dentist. Write Dr. W. Gano Compere, Blacksburg, S. C.

•

TENNESSEE—Five-room modern offices, living quarters above, on three-lane highway, three miles from Johnson City, three from Elizabethton. Will sell or lease very reasonably. Built for own use. Write Dr. W. Gano Compere, Blacksburg, S. C.

OPPORTUNITIES AVAILABLE

Dentists

CALIFORNIA—Wanted, recent graduate for new medical-dental center. Drs. Brand and Suffin, 21418 S. Norwalk Blvd., Hawaiian Gardens, Artesia, Calif. Phone Torrey 5-5296.

•

NEW JERSEY—Young dentist with interest in pedodontics or general anesthesia, to spend 2 or 3 days a week in modern office, vicinity of Newark-Elizabeth. Write qualifications. Address A.D.A. Box No. 995.

•

NEW JERSEY—Associate wanted for expanding practice in ideal community of 20,000, with possible option to purchase within six months. Attractive two-chair office, newly equipped (3 years). Excellent opportunity for new graduate. J. Clark Gleeson, D.D.S., 341 Nassau St., Princeton, N. J.

PENNSYLVANIA—(Eastern area). Large industry desires Pennsylvania licensed, draft-exempt dentist for two years only. Industrial dental health experience and knowledge essential. Exceptional training and experience in roentgenology, exodontics and general practice required. State training and experience. Address A.D.A. Box No. 981.

•

TEXAS—Wanted. Exceptionally qualified young dentist, Texas licensed, military service completed, or service free, to assume large established general practice, southwest Texas town, 15,500 population. Spacious, modern quarters; two chairs, dental laboratory, office. Fully equipped for modern dental surgery, trained assistant. Owner expects long convalescence due to injuries and major surgery. Wonderful opportunity to build career in growing city. Write Dr. G. B. Stowell, Pendleton & Arto, Inc., Houston 1, Texas, for references regarding practice and ability. Contact Ferd W. Miller, D.D.S., 214 Martin St., Uvalde, Texas.

Hygienists

CALIFORNIA—Hygienist wanted. San Francisco area. Established hygiene practice. Modern bungalow office. Doctor specializing in full mouth reconstruction. Salary $500 per month. Address A.D.A. Box No. 130.

•

NEW MEXICO—Albuquerque. Wanted hygienist for group of dentists. Very good financial opportunity. Ideal equipment and working conditions. Address A.D.A. Box No. 126.

OPPORTUNITIES WANTED

Dentist, California license, 31, desires association with general practitioner or pedodontist. Will complete tour in Army October 1955. Address A.D.A. Box No. 128.

•

Ambitious dentist, in private practice ten years, desires practice or association containing potential of bridgework and full mouth reconstruction. Have many years experience in this field. New Jersey and Pennsylvania licenses. Address A.D.A. Box No. 120.

•

Oral surgeon, age 30, married, desires association with established oral surgeon. Trained in all phases of general anesthesia. Three years' formal training, two years' clinical experience. Address A.D.A. Box No. 121.

•

Dentist, just completed tour of service, desires to purchase general practice, or would consider association. Illinois and Kentucky licenses. Address A.D.A. Box No. 118.

•

Dentist, returning from military service in August, has 16 years of private practice. Desires to buy active general practice in New York state or Connecticut. Also looking for good location. Address A.D.A. Box No. 947.

•

Oral surgeon, Pennsylvania licensed, graduate school and hospital trained, desires association with oral surgeon in established practice. Also interested in group practice. Military service completed. Will take State Board. Address A.D.A. Box No. 119.

•

Recent graduate, one year experience in pedodontics, desires association with general practitioner. Kindly describe community, practice, equipment, etc. Address A.D.A. Box No. 124.

•

Wanted to buy, oral surgery office, New York or New Jersey. Full purchase, partnership or acceptable association. Veteran, 33, married, 1944 graduate. Good training. Price secondary for excellent proposition. Address A.D.A. Box No. 127.

Wish to specialize in orthodontics or pedodontics. Desire opening in a group practice. Experience in pedodontics and orthodontics. University trained in orthodontics. Any other interesting offers considered. Licensed in New York and Pennsylvania. Willing to take any Boards for right opportunity. Address A.D.A. Box No. 122.

•

Wanted to purchase, Connecticut or New York (outside of N.Y.C.), active practice. Transferable good income. Price or condition of equipment secondary. Will consider association arrangement. Address A.D.A. Box No. 108.

WANTED TO BUY

Old or used dental books, journals, prints. Leo L. Bruder, 1 DeKalb Ave., Dept. 21, Brooklyn, N. Y. Dealer in out-of-print dental literature.

Wanted. Books, periodicals, pamphlets and miscellaneous literature pertaining to early orthodontics and children's dentistry. C. Kowal, 2743 W. 55th St., Chicago 32.

EQUIPMENT FOR SALE

Weber Imperial unit wall x-ray, S. S. White Diamond pump chair, Pelton light, 1½ years old, excellent condition. Two American cabinets, all cream white. Will sacrifice. Write P. O. Box 268, Fair Oaks, Calif.

•

Temporomandibular joints apparatus. Complete Lindblom focusing apparatus, plus technic for taking temporomandibular joint roentgenograms. New, perfect condition. Chair positioner included. Dr. N. A. Shore, 551 Fifth Ave., New York, N. Y.

SOLID BRONZE NAME SIGNS

Cast, raised letters, drilled, with screws

3" x 12" — $12.60	3" x 14" — $14.70	3" x 16" — $16.80
4" x 14" — $19.60	4" x 16" — $22.40	4" x 18" — $25.20
5" x 16" — $28.00	5" x 18" — $31.50	5" x 20" — $35.00
6" x 18" — $37.80	6" x 20" — $42.00	6" x 25" — $52.50

Other sizes 35c per sq. in. Minimum, $7.00. Signs with wording on both sides 60c per sq. in.
COLLECT PLEASE SEND CHECK WITH ORDER

LAUER METAL SHOP • 1516 E. Baltimore Street • Baltimore 31, Md.

has everything you ever wanted in a cabinet . . . yet priced far below any other cabinet of equal quality

D-906HM-43" high to formica working surface; 29½" wide; 16" deep; 6 tray-width drawers. Available in 8 colors and black.....$265.

CERTIFIED Mobile DENTAL CABINETS

- Constructed of heavy gauge steel, electrically welded throughout.
- Oven-baked enamel throughout.
- Each drawer rolls on 4 bearings for finger-tip control.

Send for FREE illustrated brochure J-3 of all models

CERTIFIED Products, Inc.

41 VAN BUREN ST. • NEWARK 5, N. J.

When performance counts...

Professional samples and descriptive literature available on request

ASTRA PHARMACEUTICAL PRODUCTS, INC.
7½ Neponset Street Worcester, Mass., U.S.A.

tops as a topical..

WIDE MOUTH JAR
For office use in all phases of operative dentistry

Council Acceptance is your assurance of high professional standards

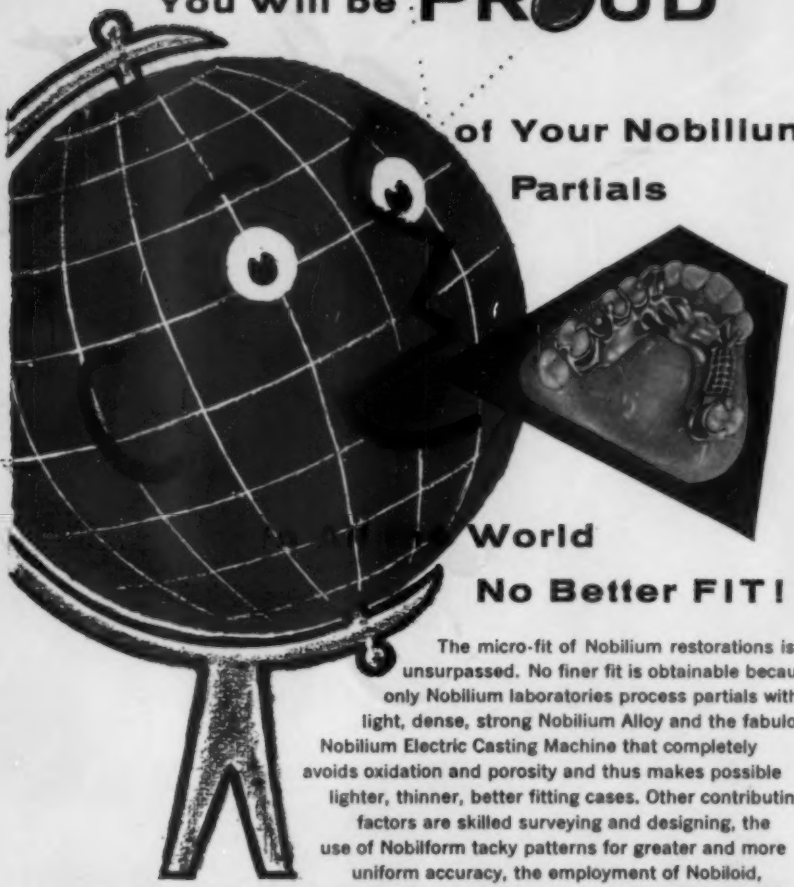
PROFESSIONAL DISPENSETS
For dentist-directed home use

- *Especially under new dentures*

Professional samples and descriptive literature available on request

ASTRA PHARMACEUTICAL PRODUCTS, INC.
7½ Neponset Street Worcester, Mass., U.S.A.

You Will be PROUD



of Your Nobilium Partials

World No Better FIT!

The micro-fit of Nobilium restorations is unsurpassed. No finer fit is obtainable because only Nobilium laboratories process partials with light, dense, strong Nobilium Alloy and the fabulous Nobilium Electric Casting Machine that completely avoids oxidation and porosity and thus makes possible lighter, thinner, better fitting cases. Other contributing factors are skilled surveying and designing, the use of Nobilform tacky patterns for greater and more uniform accuracy, the employment of Nobiloid, the better duplicating material for exacting models, and Nobilium scientific investments to realize the full possibilities of the Aristocrat of Chromium Alloys. Plus electrolytic polishing that never disturbs the precision adaptation but adds immeasurably to the comfort and lustre. You will be happy with Nobilium because your patients will be happy with Nobilium cases.

NOBILIUM PRODUCTS, INC.

Chicago Philadelphia Los Angeles

NOBILIUM of MIAMI, Miami • NOBILIUM of TEXAS, Houston

NOBILIUM of SAN FRANCISCO, San Francisco

NOBILIUM PRODUCTS of CANADA, Ltd. Toronto • NOBILIUM of EUROPE, A. B. Stockholm

Inject...

COOK-WAITE
Laboratories, Inc. 1100 BROADWAY, NEW YORK 10, N. Y.

*Reg. trademarks—Sterling-Winthrop Group, Inc.

and operate with confidence!

Quick onset (8b seconds average) permits restorative procedures to be started almost at once and carried through swiftly and deftly, confident the patient will feel no pain.

Make YOUR next order . . .

RAVOCAINE* HCl
Brand of propoxycaine HCl

AND NOVOCAIN*
Brand of procaine HCl

with LEVOPHED* or COBEFRIN*

SO FAST · SO DEEP · SO SURE

Levophed brand of levarterenol; Cobefrin brand of sorbefrin.

Incidentally . . .

So efficacious is Ravocaine HCl 0.4% and Novocain 2% with Levophed 1:30,000 or Cobefrin 1:10,000 that less than the average volume usually is entirely adequate for routine cases.

Only 'SEVRITON'

. . . has proved its claims during four years of clinical use in thousands of American dental offices.

- LASTING MARGINAL ADAPTATION
- COLOR STABILITY
- NON-IRRITATING
- DENSE STRUCTURE

'SEVRITON' (Reg. Trade Mark) ... manufactured by The Amalgamated Dental Co., Ltd., London, England under license from DeTrey Freres S. A. Zurich. AN 'AMALGAMATED DENTAL' PRODUCT

Claudius Ash, Sons & Co. U.S.A. Inc.

the ability to repair . . .

Partials weren't made to be dropped or abused . . . but they are. Changes may become necessary. G-3 partials can be repaired, adjusted or modified easily, inexpensively *and safely* . . . another case of true gold economy, using the best there is, Ney-Oro G-3.

THE J. M. NEY COMPANY Gold SINCE 1812

HARTFORD CONN.

we've put ourselves
in your shoes...

If we were you, we would want an alloy of balanced proportions and controlled expansion. We'd want a smooth-working amalgam that polishes to a hard finish. And to meet these requirements, that's just the way we've made Odontographic Alloy. No wonder more and more doctors rely on Odontographic with confidence for excellent, enduring results.

Complies with A.D.A. specifications

ODONTOGRAPHIC

IMPROVED ALLOY AND MERCURY

Alloy Manufacturers
Since 1907

ODONTOGRAPHIC
MANUFACTURING CO., INC.
62 COOPER SQUARE,
NEW YORK 3, N.Y.

ALSO AVAILABLE IN EXTRA FINE CUT

New

revolutionary

water-mix

algin-colloid

elastic

impression

material!

PAR-TEX

beats all alginates and hydrocolloids for dimensional stability!

TRIAL OFFER!

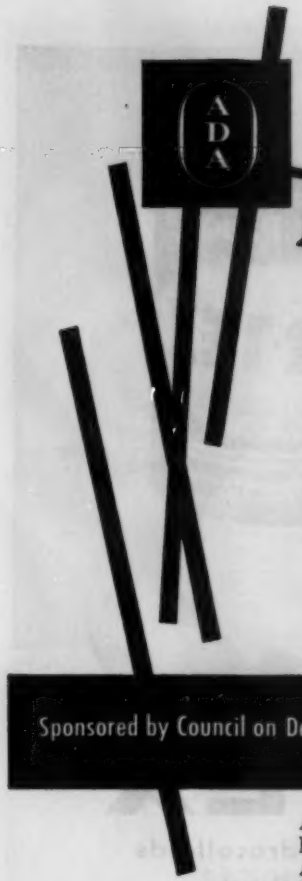
Try Par-Tex with a money-back guarantee—here's how: Buy 2-can "sampler" . . . try one can . . . if for any reason dissatisfied, return to dealer one unopened can and get full refund for cost of 2 cans. No risk for you.

- **Has least water content volume for volume.**
- **Has greater dimensional stability . . . because less water content reduces evaporation which is the cause of shrinkage between impression and model pouring.**
- **Has greater strength—freedom from tearing.**
- **Elasticity of PAR-TEX equals or exceeds any hydrocolloid.**

Order from your dealer now!

THE RANSOM & RANDOLPH CO.

Toledo, Ohio, U. S. A.



announces the

Dental Aptitude Test

for admission to 1956 Dental School Classes will be given on

OCTOBER 7-8, 1955
(application must be received by September 23)

JANUARY 6-7, 1956
(application must be received by December 21)

APRIL 27-28, 1956
(application must be received by April 13)

Sponsored by Council on Dental Education of the American Dental Association

Applicants should contact any of the dental schools listed for copies of the brochure, THE 1956 DENTAL APTITUDE TESTING PROGRAM, and for application blanks to take the tests.

Dental schools

ALABAMA
School of Dentistry
University of Alabama
1919 7th Avenue, South
Birmingham 5, Alabama

CALIFORNIA
School of Dentistry
College of Physicians and Surgeons
344 Fourteenth Street
San Francisco 3, California

College of Dentistry
University of California
University Medical Center
San Francisco 22, California

School of Dentistry
University of Southern California
925 West Thirty-fourth Street
Los Angeles 7, California

School of Dentistry
College of Medical Evangelists
Loma Linda, California

DIST. OF COLUMBIA
School of Dentistry
Georgetown University
3900 Reservoir Road, N.W.
Washington 7, D. C.

College of Dentistry
Howard University
500 W. Street, N. W.
Washington 1, D. C.

GEORGIA
School of Dentistry
Atlanta-Southern Dental College
Emory University
106 Forrest Avenue, N.E.
Atlanta 3, Georgia

ILLINOIS
Chicago College of Dental Surgery
Loyola University
1757 West Harrison Street
Chicago 12, Illinois

The Dental School
Northwestern University
311 East Chicago Avenue
Chicago 11, Illinois

College of Dentistry
University of Illinois
808 South Wood Street
Chicago 12, Illinois

INDIANA
School of Dentistry
Indiana University
1121 West Michigan Street
Indianapolis 2, Indiana

IOWA
College of Dentistry
State University of Iowa
Dental Building
Iowa City, Iowa

KENTUCKY
School of Dentistry
University of Louisville
129 East Broadway
Louisville 2, Kentucky

LOUISIANA
School of Dentistry
Loyola University
6363 St. Charles Avenue
New Orleans 18, Louisiana

MARYLAND
Baltimore College of Dental Surgery
The Dental School
University of Maryland
618 West Lombard Street
Baltimore 1, Maryland

MASSACHUSETTS
Harvard School of Dental Medicine
25 Shattuck Street
Boston 15, Massachusetts

School of Dental Medicine
Tufts University
136 Harrison Avenue
Boston 11, Massachusetts

MICHIGAN
School of Dentistry
University of Detroit
630 East Jefferson Avenue
Detroit 26, Michigan

School of Dentistry
University of Michigan
Ann Arbor, Michigan

MINNESOTA
School of Dentistry
University of Minnesota
Washington Ave. and Union St., S.E.
Minneapolis 14, Minnesota

MISSOURI
Kansas City-Western Dental College
School of Dentistry
The University of Kansas City
1108 East Tenth Street
Kansas City 6, Missouri

School of Dentistry
St. Louis University
3556 Caroline Street
St. Louis 4, Missouri

School of Dentistry
Washington University
4559 Scott Avenue
St. Louis 10, Missouri

NEBRASKA
School of Dentistry
The Creighton University
26th and California Streets
Omaha 2, Nebraska

College of Dentistry
University of Nebraska
Lincoln 8, Nebraska

NEW JERSEY
The Dental School
Fairleigh Dickinson College
Teaneck, New Jersey

College of Dentistry
Seton Hall University
Jersey City Medical Center
Jersey City, New Jersey

NEW YORK
School of Dental and Oral Surgery
Columbia University
630 West 168th Street
New York 32, New York

College of Dentistry
New York University
209 East Twenty-third Street
New York 10, New York

School of Dentistry
University of Buffalo
3435 Main Street
Buffalo 14, New York

NORTH CAROLINA
School of Dentistry
The University of North Carolina
Chapel Hill, North Carolina

OHIO
College of Dentistry
The Ohio State University
Columbus 10, Ohio

School of Dentistry
Western Reserve University
2165 Adelbert Road
Cleveland 6, Ohio

OREGON
The Dental School
University of Oregon
809 Northeast Sixth Avenue
Portland 14, Oregon

PENNSYLVANIA
School of Dentistry
Temple University
3223 North Broad Street
Philadelphia 40, Pennsylvania

Thomas W. Evans Museum & Dental
Institute School of Dentistry
University of Pennsylvania
4001 Spruce Street
Philadelphia 4, Pennsylvania

School of Dentistry
University of Pittsburgh
Thackeray and O'Hara Streets
Pittsburgh 13, Pennsylvania

TENNESSEE
School of Dentistry
Meharry Medical College
Nashville 8, Tennessee

College of Dentistry
University of Tennessee
847 Monroe Avenue
Memphis 3, Tennessee

TEXAS
College of Dentistry
Baylor University
800 Hall Street
Dallas 10, Texas

School of Dentistry
University of Texas
1018 Blodgett
Houston 4, Texas

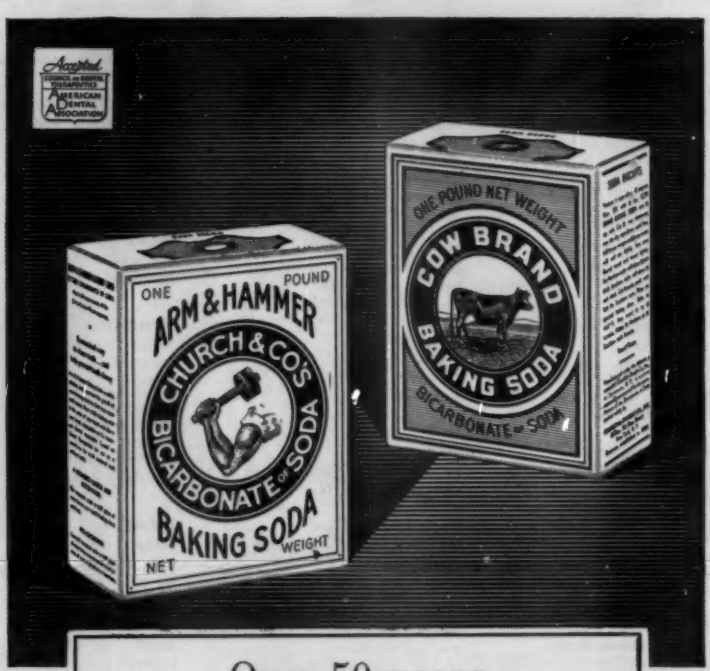
VIRGINIA
School of Dentistry
Medical College of Virginia
12th and Clay Streets
Richmond 19, Virginia

WASHINGTON
School of Dentistry
University of Washington
Health Sciences Building
Seattle 5, Washington

WEST VIRGINIA
School of Dentistry
West Virginia University
Morgantown, West Virginia

WISCONSIN
School of Dentistry
Marquette University
604 North Sixteenth Street
Milwaukee 3, Wisconsin

The dental aptitude tests are administered in 46 other colleges and universities including Hawaii, Puerto Rico and Europe.



Over 50 years still one of the finest toothpowders

Accepted by the Council on Dental Therapeutics
of the American Dental Association
as Sodium Bicarbonate U. S. P.

FREE Children's Booklets—We would like to send you children's booklets for your waiting room. They are approved by leading educators. Just write to us at the address below.

Church & Dwight Co., Inc.

70 Pine Street • **New York 5, N. Y.**

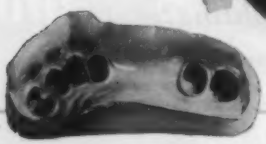
BUSINESS ESTABLISHED IN 1846

COE-flex

the Only All-Purpose Impression Material that is Really Satisfactory for –

★ INLAYS
★ PARTIALS
★ FIXED BRIDGEWORK
★ FULL DENTURES
★ REBASING
★ RELINING

All for only $5.00 per package



Exclusive!

★ Coe-Flex Retarder controls setting time as operator desires.

★ Coe-Flex Adhesive firmly attaches Coe-Flex to compound, metal, and plastic surfaces.

YOU'LL find it hard to exaggerate the wonderful qualities of Coe-Flex when you try this fabulous rubber base impression cream and pass the word along to fellow dentists! Its physical properties are quite beyond anything you used before. It is accurate, stable, strong, tough, elastic, correctible. It is easy-to-use, requires NO fixing, no special trays or equipment. And it is the *only* rubber base impression material which now includes an adhesive and a retarder in every package. Dentists who've used Coe-Flex say that it is unequaled for ALL impression work!

Order from your dealer

Coe Laboratories, Inc.
Chicago 21, Illinois

SEE THE PELTON and SEE . . . *really SEE!*

What do illuminating engineers advise for ideal dental office lighting?

1) *General lighting of the office should be maintained at a minimum of 50 foot-candles.**

This can be obtained by any one of many suitable ceiling units available at your supply company.

2) *Supplementary lighting of the oral cavity should be provided by an operating light that may be used in a multiplicity of positions to provide 150 to 1,000 foot-candles of illumination for average tasks within the mouth.**

This requirement is easily met with the Pelton Dental Light by varying the distance between the light and the mouth. Only with the Pelton is this adjustment of the intensity of light possible with so little effort.

No other light covers such a wide variation of positions with no drift so easily, so smoothly, so free of discomforting glare and shadows as this new Pelton Dental Light.

**Report by Illuminating Engineering Society.*

Yes, see the Pelton . . . and really see.
At your dealer's or write for brochure.

Professional Equipment Since 1900

PELTON

New Address after August 1, 1955

THE PELTON & CRANE CO. • CHARLOTTE 3, NORTH CAROLINA

LEADING dentists everywhere require LEADING dental equipment

MIDWEST'S TRADEMARK . . . YOUR PERFORMANCE GUARANTEE

Literally thousands of dentists have tested our equipment . . . have accepted it . . . have recommended it. The name Midwest has become a laboratory by-word because it means one thing . . . PERFORMANCE!

MIDWEST DENTAL MANUFACTURING COMPANY

Hi Speed

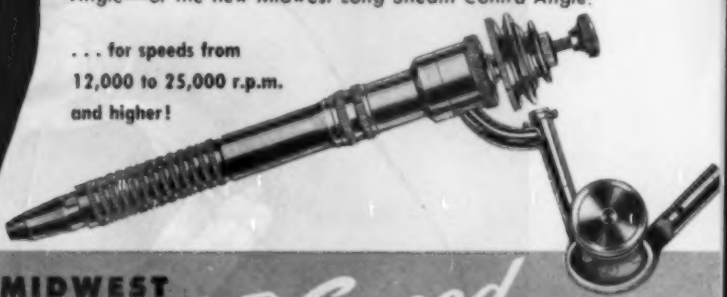
Needle Ball Bearing Handpiece means

BETTER PERFORMANCE

. . . through reduction of bearing friction . . .

All critical parts are made from Stainless Steel to eliminate the possibility of rusting from infiltration of water spray. Front ball bearings, sheath, inner sheath and spindle are all stainless. *Use the Midwest Handpiece with the conventional Contra Angle—or the new Midwest Long Sheath Contra Angle.*

. . . for speeds from 12,000 to 25,000 r.p.m. and higher!



MIDWEST Hi Speed INSTRUMENTS

Hi Speed

Long Sheath Contra Angle means

BETTER PERFORMANCE

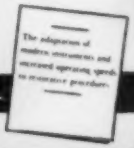
The Long Sheath Contra Angle saves time, trouble. It just SNAPS ON . . . does not require a chuck tightening rod. "Dog" type direct drive reduces vibration. Heavy Dura Chrome bearing surfaces more than double Contra Angle life . . helps the dentist do better work . . faster. Available for latch type and taper shank burs.

Complete Hi Speed Accessories that mean

BETTER PERFORMANCE

Whether you need a few accessory pieces to extend your present Hi-Speed equipment—or the complete Hi-Speed assembly, you'll find a combination that exactly suits YOU and YOUR REQUIREMENTS at Midwest.

WRITE TODAY . . for the COMPLETE Midwest Hi-Speed story. We'll be happy to mail you our catalog.



4439 WEST RICE STREET • CHICAGO 51, ILLINOIS • U.S.A.

VITALLIUM

Crafted by leading laboratories

VITALLIUM® RESTORATIONS

For over 20 years Vitallium restorations have been designed and produced in leading laboratories the country over. This is assurance to you of the superior qualities of Vitallium restorations, for these laboratories know they cannot afford to provide you with less than the best in materials and service. The tested and certified alloy, coupled with quality-controlled procedures, enables them to provide the profession with cast full and partial dentures that excel in comfortable fit, efficient function and long, useful life.

AUSTENAL LABORATORIES, INC.
NEW YORK CHICAGO

® By Austenal Laboratories, Inc.

No unpleasant odor or taste with

Paragel

Synthetic Rubber Impression Material

WRITE for FREE Technic Sheet on Paragel, or call your Dental Dealer for full information TODAY.

Paragel is ideal for lower edentulous impressions and readily adaptable for crown and bridge impressions. Paragel flows without pressure and sets sharply to a rubber-like state that is firm, yet extremely resilient. Paragel can be withdrawn over severe undercuts without distortion.

dental perfection co., inc.

543 West Arden Ave., Glendale 3, Calif.

Young Dentists

INVITATION
TO A
WORLD WIDE
PRACTICE

Regular Commissions Now Available in the U.S. Air Force

The U. S. Air Force offers you the chance to win your regular commission and work with leading members of your profession in the finest military and civilian institutions. Specialty training is available to selected individuals. Your dental status qualifies you for $1,200.00 additional annual incentive pay. As an Air Force Officer, you can see the world—and you'll have 30 days paid vacation each year. To find out more about these programs, mail the coupon today.

U. S.
AIR FORCE
DENTAL
SERVICE

D-18-ADA

THE SURGEON GENERAL
HEADQUARTERS USAF
WASHINGTON 25, D. C.

Please send me more information on my opportunities as an Air Force Dentist.

NAME_____

STREET_____

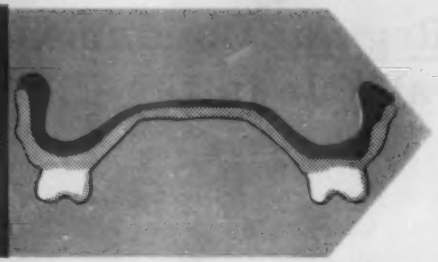
CITY_____ **ZONE**_____ **STATE**_____

2 good pointers

for professional relining at the chair

First **Contak** *takes the impression*

Then **Contak** *relines the denture*



Because it flows freely under light pressure . . . without developing bubbles or voids . . . *Contak* produces a lining precisely as thin or as thick as conditions require. *Contak* sets on schedule, allowing ample working time. It unites chemically with denture material. Moreover, *Contak* is now completely colorfast. Patient satisfaction is assured indefinitely.

REGULAR PACKAGE only $6.50. Contents: 1 bottle powder, 1 bottle liquid (sufficient for 9 relines), powder measure, liquid measure, mixing jar.

CAULK *Colorfast* Contak

for direct relining . . . professionally

For antibiotic therapy, consider

ACHROMYCIN CAPSULES

Practically all patients prefer to take medicine orally rather than by injection. ACHROMYCIN Capsules provide the dentist with a potent antibiotic in this patient-accepted form.

They also offer three other important advantages: 1) true broad-spectrum antibiotic activity, 2) continuous, effective blood levels on only four capsules a day, 3) lower cost, thus saving money for both dentist and patient.

ACHROMYCIN Capsules are indicated as an adjunct to accepted dental techniques in extractions and surgery, and in the treatment of Vincent's infection and bacterial components of gingivitis. On your prescription, patients may secure ACHROMYCIN Capsules from any pharmacy. Available to you from your usual source of supply.

FREE. For your convenience in prescribing ACHROMYCIN Lederle has prepared special prescription pads. Write for yours today!

Capsules: 250, 100, and 50 mg.
Soluble Tablets: 50 mg.

ACHROMYCIN*

Tetracycline

AN AID TO, NOT A SUBSTITUTE FOR, GOOD DENTISTRY

Lederle LEDERLE LABORATORIES DIVISION *AMERICAN Cyanamid COMPANY* PEARL RIVER, NEW YORK

*REG. U. S. PAT. OFF.

ECONOMY SIZE—1 PINT
IMPROVED
Sucaryl®
SODIUM
Sweetening Solution
NON-CALORIC
¼ teaspoon = 2 teaspoons sugar
Abbott

News about a very important word which has been added to the Sucaryl® label

As this magazine is being distributed, pharmacists all over the country are being introduced to an entirely new form of the now well-known non-caloric sweetener, SUCARYL®

The new label calls it "Improved." This means a lot of things, but for the many patients you have (and will have) on controlled, sugar-restricted diets, the big thing is this:

At last, they will have a calorie-free sweetener which in normal daily use offers complete freedom from aftertaste.

This breaks down into a number of very pointed considerations:

In its improved form, SUCARYL permits sweetening to levels never before possible with a non-caloric sweetener—greatly increasing the number and types of fully sweetened dishes which can be prepared for a sugar-restricted diet.

Even persons who get pronounced metallic or bitter tastes in other sweeteners often are unable to detect the slightest "off" taste in Improved SUCARYL.

It lends itself ideally to cooking—even more than before, for the threshold of bitterness in Improved SUCARYL has been pushed back far beyond the level of all known non-caloric sweeteners.

All this, of course, comes at no added expense to your patients. And you'll still have your choice of Tablets, Solution, and Powder, with Calcium forms for low-salt diets.

There's a brand new recipe booklet waiting for your patients at all drug stores. Why not spring the good news on them today?

FREE TECHNICAL LITERATURE

Check the plastic products in which you are interested. Attach your professional card, and mail. We will send you the latest technical information on:

JUSTI

Products for Better Dentistry

- ☐ S.R. acrylic denture teeth.
- ☐ S.R. characterized anteriors.
- ☐ Four types of posteriors including short-bites.
- ☐ Justi acrylic facings.
- ☐ Justi-tone denture base material.
- ☐ S.R. denture base material.
- ☐ Justi Liqua-Color.
- ☐ C.B.F.—crown and bridge material, cross-linked
- ☐ Gol-Shank tungsten carbide bur; 28 sizes—A.H.P. and S.H.P.
- ☐ Justi anti-bacterial acrylic cement.
- ☐ Justi anti-bacterial reline material.
- ☐ Justi Muco-Seal.

S&R

H. D. JUSTI & SON, INC.
3148 Spring Garden St. • Phila. 4, Pa.

"YORICK"
Skull is 3½" x 2¼"

Price
$15.00

With This Miniature Ivorine Skull You Can SHOW Patients What You're Talking About

Invaluable in Educating Patients to Accept Your Concepts of Advanced Dental Service. Suggestions on Its Use Accompany Skull.

If you do not have our Catalog No. 33, write for your copy today.

COLUMBIA DENTOFORM CORPORATION

"The House of A Thousand Models."

131 East 23rd Street New York 10, N. Y.

Doctors say "It helps me relax!"

Many physicians and dentists and other busy professional people are taking up the Hammond Chord Organ as a relaxing and enjoyable hobby. It's the organ anyone can play, without taking lessons or knowing music.

You can play a tune in 30 minutes on the Hammond Chord Organ

One finger plays the melody. *One finger* adds rich, full chords. If you don't read notes, you use Picture Music that anyone can follow. In a few days, you'll be playing all sorts of selections—popular, religious, even classical!

Try the Hammond Chord Organ at your dealer's and see. No obligation. And mail coupon for further details. $975, f.o.b. Chicago, in Walnut. Blond or Ebony slightly higher. Terms arranged.

The Hammond Chord Organ

by the makers of Hammond Organs

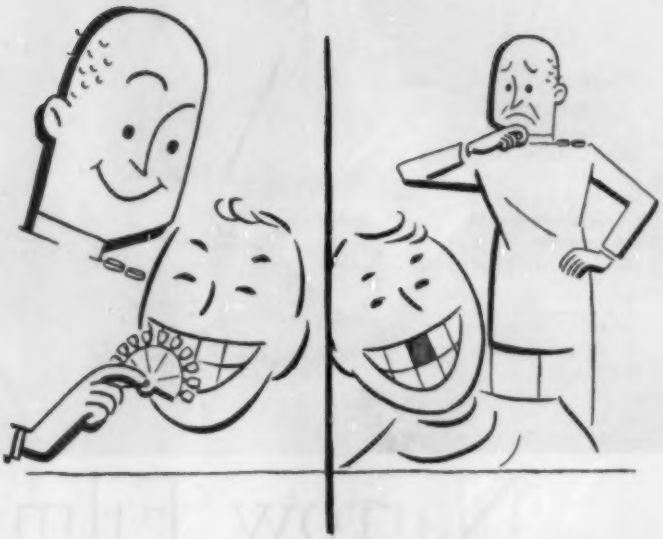
Hammond Organ Company
4242 W. Diversey Ave., Chicago 39, Illinois
Without obligation, send details about the Hammond Chord Organ.

Name_____

Address_____

City_____ Zone_____ State_____

© 1955, HAMMOND ORGAN COMPANY



Avoid this by using Steele's Gol-Fac Backings. They preserve the original colors of New Hue Facings and Trupontics. You can see the advantages.

Steele's

GŌL-FĀC BACKINGS

The Columbus Dental Manufacturing Company • Columbus 6, Ohio

Narrow Film

NOW! UNDISTORTED ANTERIOR RESULTS... LESS PATIENT DISCOMFORT

Utilize the advantageous "Narrow Technique" Narrow Film—an original Rinn research development—is specifically designed for more positive anterior results. Ideal also for all interproximals and teen age junior periapicals because:

- **More Accurate Film Placement**
- **Eliminates Distortion -- No Bending**
- **Increases Patient Comfort**

Rinn

Try the "Narrow Technique" for convincing results. Samples on request.

Rinn X-Ray Products, Inc.,
2929 North Crawford Avenue, Chicago 41, Illinois

LEADERS IN DEVELOPMENT OF DENTAL X-RAY TECHNIQUES AND PRODUCTS

ONLY SHELLEY

gives you a genuine

WOOD GRAIN FINISH

to perfectly match the color of

YOUR UNIT AND CHAIR

It's Stain proof too!

SEND FOR 5 COLOR CATALOG

Shelley

"WORLD'S FINEST DENTAL CABINETS"

Shelley Dental Mfg. Co. Dept. A
305 Glendale Blvd., Los Angeles 26, Calif.
Send complete information on Shelley Mobile Dental Cabinets.

Name_____

Address_____

City_____ Zone____ State_____

My dealer is_____

Get there faster... arrive fresh and relaxed!

FLY UNITED

to the annual convention of the

AMERICAN DENTAL ASSOCIATION

San Francisco, October 17—20

Fly United to the convention! You're only hours away on the Main Line Airway, and United's great new DC-7s—the fastest, most luxurious airliners, now fly from New England, Chicago, New York, Washington, D.C. to San Francisco. Just imagine—leave New York at 1 p.m., be in San Francisco at 6:45 p.m.!

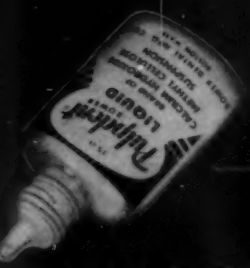
United's First Class service offers an economical family plan, optional routing that permits you to visit other cities at no additional cost, plus expert trip planning and reservation assistance. Thrifty Air Coach service also available.

Pre- and Post-convention tours to Hawaii

Fly fast United Mainliners to Honolulu and return by ship or plane. For complete information and details, see your nearest authorized travel agent or United ticket office.

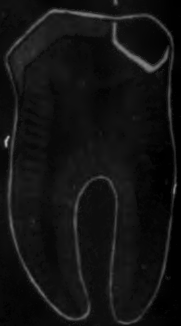
UNITED AIR LINES

Call your nearest United office today!



A SUCCESSFUL RESTORATION

needs a perfect foundation



Pulpdent® LIQUID*

ROWER

Brand of CALCIUM HYDROXIDE SUSPENSION

Used as a cavity liner, Pulpdent (Rower) Liquid neutralizes cement acids and minimizes thermal shock, the two sources of pulpal irritation most commonly encountered in restorative dentistry. Pulpdent (Rower) Liquid adheres readily to cavity walls; does not interfere with the retention of cement and is truly an essential component of the perfect foundation necessary for successful restorations.*

Pulpdent® PASTE

ROWER

*U.S. Pat. No. 2,599,445

Brand of CALCIUM HYDROXIDE PASTE

Possesses all the properties of Pulpdent (Rower) Liquid as described above, plus the ability to aid in forming a secondary dentin barrier over exposed pulp tissue. Heavy, paste-like consistency facilitates its special use in vital pulpotomy and pulp capping.*

Group A Acceptance announced J.A.D.A. 50:334 (Mar.) 1955

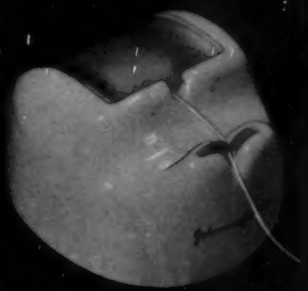
ROWER DENTAL MFG. CORP. Boston 16, Mass., U.S.A.

**Bibliography and descriptive literature available on request.*

New!

Handsome!

Flossfont



- Simple to use and refill.
- White glossy porcelain—non-skid rubber base.
- Complete with 100 yards Dentotape®—$3.50.
- With 200 yards Floss—$3.75.

Write for copies of booklet, "How to Use Dental Floss," for distribution to your patients.

Johnson & Johnson

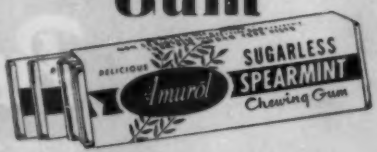
New Brunswick, N. J.

for caries-active patients *prescribe*

Amurol

NON-CARIOGENIC

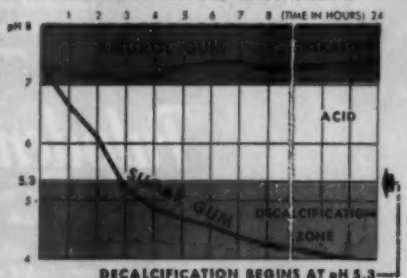
Sugarless Gum



Sold through drug, department and health food stores. Samples and literature on request. Please give druggist's name, address.

AMUROL PRODUCTS COMPANY
116 S. MICHIGAN AVE., CHICAGO 3, ILL.

Comparative *in vitro* Effects of Sugar Gum and Amurol Gum added to Saliva



DECALCIFICATION BEGINS AT pH 5.3

As shown above, pH of caries-active saliva *in vitro* remains in alkaline zone for hours with AMUROL SUGARLESS GUM, whereas with sugar gum the pH drops to the acid level under the same conditions.

a pin

may not lead to a denture repair

BUT...

IT'S EASY TO SAFEGUARD

DENTURES AGAINST REPAIRS

DUE TO PIN-LINE BREAKAGE

Micromold PORCELAIN *Teeth*

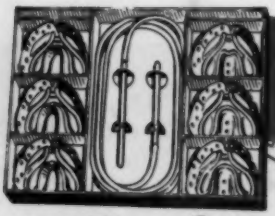
THEY HAVE NO PIN-LINE

Prescribe or obtain Micromold Porcelain Teeth through your Vitallium Laboratory

AUSTENAL LABORATORIES, INC.

224 EAST 39TH STREET, NEW YORK 16, N.Y.

5932 WENTWORTH AVE., CHICAGO 21, ILL.



PW JC

THEY GO TOGETHER *to assist you!*

SURGIDENT'S PERIPHERY WAX·· JIFFY COOL IMPRESSION TRAYS

JC Surgident

JIFFY-COOL IMPRESSION TRAYS

Jiffy-Cool Impression Trays have advantages not found in any other tray. They are water cooled for hydrocolloids and may also be warmed with warm water to speed setting of alginate material. These durable trays may be trimmed or bent and fitted to an individual mouth, are easily cleaned and all parts are replaceable. A set of Jiffy-cool trays includes 6 complete trays, 2 rubber tubes, 2 glass adapters. A $15 value for $12. Parts may be purchased individually.

PW Surgident

PERIPHERY WAX

A new formula wax for making stops, post-damming and lining the periphery of the tray. Extra soft for minimum tissue displacement. Tacky for quick adherance to the tray. Easily conformable at room temperatures, yet may be tempered safely in hydrocolloid techniques. 60 sticks to box, $3.00.

Your Dental Dealer will supply you

Surgident Ltd.
WEST LOS ANGELES 25, CALIF.

BAKER CRISTOBALITE

INVESTMENT

UNIFORM EXPANSION OVER AN EXCEEDINGLY WIDE CASTING RANGE!

Baker Cristobalite Investment for inlays, bridges and large castings has a *uniform* expansion of from 1.2% to 1.3% over a broad temperature casting range! This is just what you need when making molds into which you cast precious metal alloys which shrink on an average of 1.25%.

You get maximum strength and smooth mold surfaces with Baker Cristobalite—and you'll find it washes away very easily under running water after casting.

Available through your dealer in 5, 15, 50 and 100 lb. containers.

BAKER

BAKER & CO., INC.

850 PASSAIC AVE. · EAST NEWARK, NEW JERSEY

SUPERIOR STEEL . . . SCALPEL SHARP!

For *fastest, smoothest* cutting, *you'll get best results* with Busch Burs . . . the bur that withstands wear and holds "scalpel-sharp" edges through long, long service. *These* blade sequences *are engineered* for cutting with a very minimum of pressure and vibration.

At best, dental drilling can never be termed a pleasant experience—but Dentists do find that Busch Burs are by far, the kindest to their patients.

We can only *describe* the action of smooth cutting but you'll appreciate it the very first time you use a Busch Bur. Order a supply through your own depot—you'll be glad you've tried them. ★ ★ ★ ★ ★

BUSCH BURS

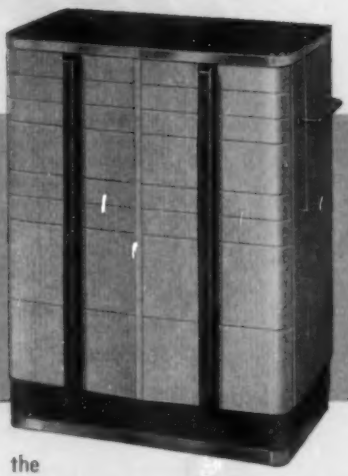
PFINGST & COMPANY, INC.

62 COOPER SQUARE • NEW YORK 3, N. Y.

BUSCH BURS • HORICO DIAMOND ABRASIVES • AJUSTO HAND PIECES • STAINLESS INSTRUMENTS

If it's efficiency you want most in a cabinet...

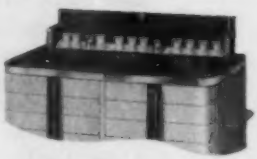
AMERICAN...by Hamilton

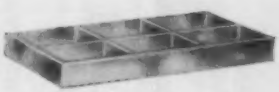


Maximum efficiency—inside and out. Typical American mobile cabinet—Model 176. Commodious, but moves easily on rollers—for instant access to 16 drawers, with 24 assorted glass trays (like those shown), 14 bottle in concealed medicine compartment, lead-lined film box, silicate and cement inserts. Raised-rim top of unbreakable, easy-to-clean gray grid Formica.

When you buy an American Cabinet — as the majority of dentists do — you make one of the soundest investments of your career. You acquire modern beauty for your office — convenience to make your work easier — and, above all, numerous features to complement your own skill for neat, swift, efficient dentistry.

Four of the five American models are mobile (permitting seated work) and every model is available in five handsome Colortone finishes. See them soon at your American dealer — or write us for his name.





Hamilton
AMERICAN CABINETS

HAMILTON MANUFACTURING COMPANY

Two Rivers, Wisconsin

PATIENT LOVES DENTIST

Patients accept dental care more readily when the fear of pain is allayed. By making BUFFERIN a part of your pre- and post-treatment routine you can minimize the discomfort of dental procedures, and thus gain the cooperation of your patients. The side effects, nausea, heartburn, which follow the use of straight aspirin by some patients, are markedly less when BUFFERIN is the analgesic used.

Accepted COUNCIL on DENTAL THERAPEUTICS AMERICAN DENTAL ASSOCIATION

GIVE **BUFFERIN.**

Acts Twice as Fast as Aspirin
Does Not Upset the Stomach

BRISTOL-MYERS COMPANY, 19 West 50 St., New York 20, N. Y.

B stands for Blond

blonde, [F., < L.L. blondus, yellow], 1. blond; 2. blond, a. 1, having a fair skin, light (usually blue) eyes, and fair hair; xanthochroic; said of a person; 2, flaxen or golden; said of hair.

B also stands for Bioform®

WHEN YOU SPECIFY TOOTH SHADES . . .
SPECIFY B FOR BIOFORM

. . . and whether your patient's requirements be brunette or redhead, you'll find there's always a suitable shade to harmonize with age and complexion in Trubyte Bioform.

Trubyte Bioform shades have a lustrous, radiant vitality and *natural* shading which compare most favorably with healthy natural teeth. Your Trubyte Bioform shade guide is the key to the most natural appearing shades in artificial teeth. Start specifying "B For Bioform" today and you'll note immediately the improved esthetic appearance of your complete and partial denture cases.

TRUBYTE Bioform® THE FIRST VACUUM FIRED PORCELAIN TEETH

ASK YOUR TRUBYTE DEALER

to show you the "10 Features of Trubyte Bioform Color Superiority"

THE DENTISTS' SUPPLY COMPANY of N. Y.
York, Pennsylvania